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Experimental Studies of Mental Defectives

A Critique of the Binet-Simon Tests and a Contribution to the Psychology of Epilepsy

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EDITOR'S PREFACE.

In this, the seventh of the series of Educational Psychology Monographs, Dr. Wallin has presented the results of a systematic critical study of the Binet-Simon scale when applied to a colony of over three hundred epileptics.

These results will appeal to schoolmen and to physicians and alienists for two reasons. In the first place, they have added to our knowledge of the mental status of the epileptic. Epilepsy has long remained a little-understood disease. We are told that some men who have attained eminence have been epileptic, *e. g.,* Julius Caesar, Mohammed, and probably St. Paul, to cite conspicuous instances; yet the great majority of those afflicted with the malady fail to reach normal mental maturity, and fall, as Dr. Wallin shows, into the upper group of the feeble-minded, now known as morons. These children resemble more the typical laggard of the public schools than the typical feeble-minded child, and they require special educational treatment. For this reason the more we can discover as to the psychology of the epileptic, the more successful will be our educational measures.

In the second place, these results have added to our knowledge of the Binet-Simon tests. The fact that these tests are being widely adopted by school authorities as a convenient and assumedly scientific

method of measuring retardation or acceleration of mental development makes any careful study of their reliability of direct practical importance. And the more so, because, as Dr. Wallin's investigation shows, the tests in question are far from being so simple and so universally applicable a tool as many laymen have supposed. On the contrary, despite their undeniably great practical value, they suffer from numerous imperfections and limitations. These defects can be made known only by thoroughgoing trial on large groups of individuals by expert investigators. This monograph makes a valuable contribution to this critique of the tests. Dr. Wallin believes that the reconstruction and perfection of the tests by competent research should not be allowed to conflict with the continued use of the 1908 scale according to prescribed standard conditions. For this reason a guide to the conduct of the 1908 series (reprinted, with the permission of its editor, from *The Psychological Clinic,* December 15, 1911) is incorporated herewith as the final chapter of the monograph.

GUY MONTROSE WHIPPLE.

TO MY FIRST PRECEPTOR
IN PSYCHOLOGY AND PHILOSOPHY,
EDWARD FRY BARTHOLOMEW.

FOREWORD.

The following experimental studies represent some of the fruits of my psychological and anthropometric investigations of epileptics in The New Jersey State Village for Epileptics at Skillman from October, 1910, to and including May, 1911. A second comparative psychological research of public school children and epileptic school children, by a set of serial rate tests of development, will appear in a separate volume at some later date.

I feel that no apology is needed for the time and pains devoted to the critical examination of the Binet-Simon scale of intellectual development. This scale has recently been victimized by the indiscriminate exploiter. It has been hailed by popular writers in the daily and periodical press, and even by scientific workers, as a wonderful mental X-ray machine, which will enable us to dissect the mental and moral mechanisms of any normal or abnormal individual.

But these tests are no "open sesame" to the human mind, no talisman that will transform an ordinary observer into a psychic wizard. Because the scale is coming into wide use in the public schools, the psychopathic and criminological institutes, and institutions for mental and moral defectives, and because it is being appropriated by ordinary classroom teachers and persons having no technical training in clinical psychology or knowing little about scientific method in general, it is worth while to point

out its legitimate uses as well as its limitations and present imperfections. These tests need to be safeguarded from uncritical exploitation and mystification, and rescued from the educational fakers and medical quacks. I shall feel well repaid for my labors if this contribution arouses students to a full realization of the necessity of a further prolonged and systematic critical study of the scale.

These studies—as well as those which will follow—should appeal to the students of defectives and the problems of human variation. The serviceability of the Binet-Simon scale, despite its imperfections, in determining the mental status of defectives, will be seen. Moreover, the study of epileptics should interest particularly the alienist and physician, and the schoolman: the alienist and physician, because epilepsy is a pathological condition as yet little understood, characterized by marked mental disturbances; the schoolman, because the epileptic children constitute a numerous class which grades nearer the public school laggard than do the feeble-minded children, and which cannot be reached by the cut-and-dried methods of the schools, but which requires a special educational regime.

I have designedly contented myself with a purely empirical and experimental exposition, leaving the reader to work out the implications and draw his own conclusions from the facts supplied. The facts tell their own story. To have pointed out the various practical and theoretical implications affecting the education, care and training of epileptics would have unduly extended the size of the monograph.

J. E. W. W.

February, 1912.

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CHAPTER I.

INTRODUCTION. THE BINET-SIMON SCALE AS AN INSTRUMENT FOR CLASSIFYING MENTAL DEFECTIVES.[1]

The functions of a clinical psychologist in an institution for defectives, in a public school system, in a university, in a psychiatric institute, or in a juvenile court, are twofold: first, that of *theoretical investigation,* or the increase of knowledge under controlled and verifiable conditions. This is essentially the work of the *research* psychologist or of pure science, so-called; second, that of *practical application,* or the utilization of the truths discovered in the educational, vocational, recreational, hygienic, medical and custodial treatment of the sufferers. This is the work of the *consulting* psychologist as distinguished from the pure researcher, and constitutes the sphere of orthogenesis,[2] mental hygiene, or applied clinical psychology. While the line of demarcation between these two aims should not be made too fast and hard, logically the work of investigation in an infant science should take chronological precedence to the work of consultation, as, indeed, science logically must precede true art. The art of righting defectives cannot rise above the empirical until it is

[1]This chapter has been adapted, by permission, from a paper read before the St. Louis meeting of the National Association for the Study of Epilepsy, and printed in the Transactions of the Association for 1911, Vol. VIII, pp. 29f.

[2]In its twofold aspect of orthophrenics and orthosomatics, as explained elsewhere: J. E. Wallace Wallin, Individual and Group Efficiency, *Psychological Bulletin,* 9: 1912, October.

based upon a foundation of assured facts. Until we thoroughly understand the different types of nervous and mental defectives our treatment cannot be made maximally effective. For these reasons I purposely aimed to confine my work in the psycho-clinical laboratory at Skillman entirely to research, and for these reasons I shall limit the discussion in the following pages almost entirely to a consideration and interpretation of the *facts* brought out in the investigations.

During my eight months' stay at the institution the following surveys[1] of the Village were completed (completed as far as measuring or testing each patient once is concerned): measurements of standing and sitting heights, of weight, of lung capacity, of the strength of right and left hand grip, of station or body sway, of the speed of performing the form-board test (replacing ten blocks of various forms in corresponding holes in a board), and of intellectual capacity, or the extent of intellectual retardation, as evidenced by the Binet-Simon serial diagnostic scale.

In addition to the above, a special set of tests was carried out, designed to show the character and extent of the deviation or disorganization found in epileptics in respect to a number of particular mental traits and capacities which play a basic rôle in men-

[1]The other lines of investigation started during this period comprise a series of measurements of the effects of convulsions upon various mental traits and capacities, and an investigation into the personal, social, motor, industrial and school efficiencies of epileptics. The latter was carried out by means of the printed questionnaire or syllabus method. See Wallin, Human Efficiency: A Plan for the Observational, Clinical and Experimental Study of the Personal, Social, Industrial, School and Intellectual Efficiencies of Normal and Abnormal Individuals, *Pedagogical Seminary*, 18: 1911, 74ff.

tal development. These tests include an extended series of controlled group measurements of the speed and accuracy of perception, perceptual discrimination, observation and reaction; the capacity to memorize, and the power of immediate and prolonged retention; the capacity and rate of forming spontaneous associations with determinate antecedents; the ability to form such controlled associations as are involved in adding columns of ten one-place digits and of supplying antonyms to a set of simple words; the ability to retain a list of logical and illogical sequents, with determinate antecedents, from one reading by the experimenter both during a period of two minutes and during a period of four weeks; the capacity for visual imagination, and the capacity for linguistic construction as evidenced by the ability to construct a maximal number of words from six supplied letters, and by the ability to form a maximal number of sentences each of which had to contain three supplied nouns or verbs. This set of differential tests was elaborated into six consecutive series and was given every twenty-eighth day to groups of the brightest epileptic school children at the Village and to somewhat less than 100 bright, average and backward pupils in the public schools of a nearby town. The results of the testing in the public schools will enable us to plot a series of *normal age norms* of the functional capacity of the various traits tested. By means of such comparative scales or indices it will not only be possible to bring epileptics, or other types of defective individuals, into perspective with normal children, but to plot *individual curves of developmental defects or accelerations* in the case of any abnormal or supernormal

child. Moreover, since all of the successive tests, while different, are practically of the same difficulty, it is possible, by giving them at stated intervals (monthly, semi-annually, annually, etc.), to plot *rate* curves of development; that is, it is possible to measure experimentally the *rate of improvement or development* which various mental traits undergo from time to time as a result of normal maturation, or of education, training, practice, or familiarity.[1]

The desirability, or even the feasibility, of establishing *psychological rate-norms* of development has, strangely, scarcely dawned upon us until recently, although the practical value of such norms is possibly greater than the value of the corresponding anthropometric standards of yearly development during the growth period of height, weight, physical energy and vital capacity. The importance of a set of anthropometric norms, arranged on the grade or percentile basis, has been eloquently set forth by the lamented Sir Francis Galton, to whose comprehensive intellect many sciences have become indebted. Thanks to the labors of a few of Galton's followers, notably Bowditch, Porter and Smedley, we now possess a set of fairly reliable norms of physical development for certain ages, by means of which we are able to determine the *physical station* of a given child of a given age, and by means of which we can say whether his physical progress is normal or sat-

[1]One of my aims in devising these tests was to secure experimental means for measuring *results in education*, such as the effects of dental and medical hygiene, schoolroom moisture and temperature, diurnal and seasonal changes, fatigue, the use of tobacco, upon the working efficiency of the pupil, and upon the growth and development of various mental functions. A description of five of these tests will be found in Wallin, Experimental Oral Euthenics, *Dental Cosmos*, 54: 1912, 404-413; 545-566. (See also references.)

isfactory as measured by the percentile grade to which he belongs (using height as the basis of comparison). But we are now beginning to realize that we cannot properly diagnose developmental defects of the mind until we have constructed a similar set of *psychic norms* of development of various traits and capacities. When we have psychic norms for specialized capacities, we shall be able to locate the *mental station* of a given child at a given time, and determine whether his rate of mental development is normal for the grade in which he classifies. These norms will possess fundamental value for purposes of developmental diagnosis in the study of not merely the lesser deviations, but also the more profound mental abnormalities. To supply these mental developmental scales is chiefly a matter of time, labor and ingenuity: the instrumental and technical difficulties are secondary. Such scales will not, of course, attain the accuracy of refined physical measures, but they will be far superior to our present 'common sense' judgments. The fair degree of success attained by the simple Binet-Simon tests of intelligence justifies the belief that this problem, baffling as it seems, is not insoluble. By means of the above serial group tests I am hoping at some later date to make some little addition to our knowledge in this largely unexplored, but inviting and important, field of inquiry. Aside from the value which the data from these tests will have for developmental diagnosis, the results may also be used as a means by which to check up the accuracy of the Binet-Simon tests, with the consideration of which I shall be chiefly concerned in the present volume. The latter tests are such a striking contribution to our methods

of studying defectives that too much time cannot be spent in the effort to give them their proper evaluation.

Those who may be unfamiliar with the B.-S. (Binet-Simon) tests should consult Chapter IV. It may be explained here that they constitute an extremely simple and yet fairly serviceable measuring rod of intellectual capacity. The scale consists of a graded series of 62 individual tests (including the one- and two-year-old tests), varying in number from three to eight for each of the first thirteen years of life. To illustrate: a child who follows visually a lighted match moved in front of his face, who grasps and handles a block placed in his hand, and who grasps a suspended cylinder, is credited with a mentality of one year. A one-year-old child normally does these things. A child who can state his sex, who recognizes common objects, such as a knife, penny and key, who can repeat three numerals when heard once, and who can designate the longer or shorter of two lines differing by one centimeter, is rated as four years old mentally. By means of a scale of this sort it is possible, therefore, to *classify* individuals approximately according to their degree of intelligence, and to measure the extent of intellectual arrest, retardation or degeneration shown by subnormal individuals, or the extent of precocity or acceleration shown by supernormal individuals. This scale is the product of laborious and ingenious research by the noted French psychologist, Binet, and his co-worker, Simon. The standards fixed for each age are supposed to represent the normal performances of French children of the working classes.

In the present chapter I shall limit myself to show-

ing how a colony of epileptics classify by the B.-S. scale, and to pointing out certain striking peculiarities or anomalies in the curve of distribution, which, while they may be caused by various factors, either implicate fundamental abnormalities in the mental make-up of the epileptic or fundamental defects in the B.-S. tests.

GRAPH I.

Classification of 333 Epileptics (————) and 378 Feeble-Minded (- - - - - -) by the Binet-Simon Method.

TABLE I.

Tabulation of Mental Ages (Binet-Simon) of 333 Epileptics.

B.-S. Age.	Children (under 21)						Adults (over 21)										Entire Population.	
	Boys.		Girls.		Both sexes.		Men.		Women.		Both sexes.		Males.		Females.			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
I	3	4.4	0		3	2.7	2	1.7	1	0.9	3	1.3	5	2.7	1	0.6	6	1.8
II	4	5.9	2	4.6	6	5.4	2	1.7	5	4.6	7	3.1	6	3.3	7	4.6	13	3.9
Id.	7	10.3	2	4.6	9	8.1	4	3.4	6	5.5	10	4.4	11	6.0	8	5.2	19	5.7
III	4	5.9	3	7.0	7	6.3	4	3.4	0		4	1.7	8	4.3	3	1.9	11	3.3
IV	5	7.4	4	9.3	9	8.1	2	1.7	5	4.6	7	3.1	7	3.8	9	5.9	16	4.8
V	1	1.5	2	4.6	3	2.7	3	2.6	4	3.7	7	3.1	4	2.1	6	3.9	10	3.0
VI	4	5.9	6	14.0	10	9.0	7	6.1	5	4.6	12	5.8	11	6.0	11	7.2	22	6.6
VII	5	7.4	6	14.0	11	10.0	9	7.8	12	11.1	21	9.4	14	7.6	18	11.9	32	9.6
Imb.	19	28.1	21	48.9	40	36.3	25	21.6	26	24.0	51	22.0	44	24.1	47	31.1	91	27.3
VIII	9	13.4	6	14.0	15	13.6	20	17.4	20	18.5	40	17.9	29	15.9	26	17.2	55	16.5
IX	6	8.9	3	7.0	9	8.1	10	8.7	9	8.3	19	8.5	16	8.7	12	7.9	28	8.4
X	16	23.8	8	18.6	24	21.8	27	23.4	32	29.6	59	26.4	43	23.6	40	26.4	83	24.9
XI	6	8.9	2	4.6	8	7.3	15	13.0	5	4.6	20	8.9	21	11.5	7	4.6	28	8.4
XII	2	3.0	1	2.3	3	2.7	5	4.3	3	2.7	8	3.5	7	3.8	4	2.6	11	3.3
Mor.	39	58.0	20	46.5	59	53.6	77	66.8	69	63.7	146	65.4	116	63.7	89	58.9	205	61.5
XIII	2	3.0	0		2	1.8	9	7.8	7	6.5	16	7.1	11	6.0	7	4.6	18	5.4
T'l..	67		43		110		115		108		223		182		151		333	

Id.=idiots. Imb.=imbeciles. Mor.=morons. Age XIII=retardates, deviates or normals. No.=number of patients included in the averages. The Binet-Simon ages are given in Roman numbers throughout the book. The basis of grading is the highest age passed plus advance credits, in accordance with Binet's directions, irrespective of whether or not the patient failed to pass some lower age. A mentality of II years means from II to, but not including, III years. Thus a child grading 2.8 years is classed as two years old mentally. Similarly for the other ages.

Confining our attention to the gross or the group classification, it is seen that the 333[1] epileptics included in Table I classify as follows: 5.7% are idiots (mentality of I and II years), 27.3% are imbeciles (mentality of III to VII), 61.5% are morons (mentality of VIII to XII), and 5.4% have a mentality of XIII years or over.[2] In all, 82.8 % have a mentality of less than eleven years. The idiot and the XIII-year-olds are about equally infrequent, while the morons are decidedly preponderant.

These results will attain added significance if we compare them with the B.-S. distribution for the 378 feeble-minded inmates tested at the Training School in Vineland, New Jersey.[3] Nineteen and two-tenths per cent. of the feeble-minded are idiots, 54% are imbeciles, 26% are morons, not a single one grades as thirteen, and 96.4% grade less than eleven years of age mentally.[4] The feeble-minded idiots are about three and one-half times as numerous as the epileptic idiots, and the feeble-minded imbeciles about two times as numerous as the epileptic imbeciles. On the other hand, the epileptic morons are more than two

[1]Those epileptics were excluded from the tabulation who had not had a convulsion within a period of two years, and a few others who were not thoroughly tested because of certain sensory defects. The number of patients of each mental age is shown in Table I. The patients were in their normal condition during the testing. Patients who passed in two of the 13-year tests were credited with this age, provided they also passed at least five tests in Ages XI and XII. Drawing one triangle was accepted for the first of the 13-year-old tests.

[2]Ages printed in Roman numerals throughout this monograph refer to mental as distinguished from chronological age, and refer to the mental ages indicated in the Binet-Simon scale.

[3]Henry Herbert Goddard, *Journal of Psycho-Asthenics*, 15 (Nos. 1 and 2), 1910.

[4]The per cents. for each age are as follows: Age I, 9.5%; II, 9.7%; III, 10.5%; IV, 9.8%; V, 11.1%; VI, 10.2%; VII, 12.4%; VIII, 11.6%; IX, 7.9%; X, 3.7%; XI, 1.3%, and XII, 1.8%.

and one-half times as numerous as the feeble-minded morons. While the great mass of people in both of these classes of defectives have a mentality of less than XI years, the proportion is 13.6% greater among the feeble-minded than among the epileptics. As found in institutions at least, the typical epileptic condition is moronity (five-eighths of the entire number), while the typical feeble-minded condition is imbecility (more than one-half of the entire number).

These figures indicate that there is a marked difference between the grade of intelligence of epileptic dements and that of feeble-minded retardates.[1]

One reason for the superiority of the epileptics may be the fact that, relatively, a larger number of the feeble-minded than of the epileptics were *youths*. Fifty per cent. of the feeble-minded were under 21, while only 30% of the epileptics were under 21. As the B.-S. scale is now constituted, it may be assumed that defective adults will grade somewhat higher than defective children, as is indeed indicated in Table I. Sixty-five and four-tenths per cent. of the adults are morons (mentality of from Age VIII to Age XII, inclusive), while only 53.6% of the children are morons, and 7.1% of the adults grade XIII years as contrasted with 1.8% of the children. The adults among defectives possess a larger storehouse of experience and acquired knowledge. At the same time, the epileptic superiority will attain added prominence

[1]Space does not avail to point out the practical implications of this fact, but we may emphasize a growing conviction that epileptic and feeble-minded persons should not be huddled together in the same institution. The differences in the mental station—not to mention other significant differences—between these two classes are such that they can be most humanely cared for in separate institutions, or at least in separate divisions in the same institution.

if we constitute the XIII-year-olds a separate class above the feeble-minded line, which we may regard as normal, or as retarded or deviating, though not to such an extent as to render the individuals feeble-minded. We should then have to add to this class all the epileptic children who are retarded less than three years (children retarded less than three years should probably not be rated as feeble-minded). There are nine of these—five boys and four girls. Adding these to the XIII-year-olds, we get a total of 27[1] normals, or deviates, which is 8.1% of the entire group.

This figure (8.1%) we are justified, I believe, in regarding as a lower limiting value for two reasons. First, the tests in the higher ages are, as will be seen in later pages, too difficult for the typical American child for the ages to which they are assigned. To get a check on these higher tests, I made use of the following means: A few of the supervisors and officers at Skillman who had known the patients intimately for a considerable length of time were asked to prepare estimates of the number of patients whom they regarded as ranking above the feeble-minded station. Three of these officers, quite independently, made for the total population the same estimate, namely, 10%. Five men made separate and independent estimates of the total male population as follows: 11, 11, 13, 14 and 20%. With one exception, these estimates agree fairly well. With the tests as at present constituted, it is a question whether the line of feeble-mindedness should not be drawn *be-*

[1]It is interesting to note that among these 27 there is only one who can be regarded as above normal, a boy somewhat less than twelve years who grades as thirteen.

tween eleven and twelve instead of between twelve and thirteen, as has been done tentatively by the American Association for the Study of Feeble-Mindedness. A number of our XII-year-olds certainly are very slightly, if at all, feeble-minded.

A second reason why the percentage of normals may be too low is the fact that the institutional cases at Skillman may not be representative. Our curve in general is valid on the assumption that the epileptics tested are typical. According to the theory of the probability surface, we are justified in regarding them as typical, provided the selection represents a chance distribution. But it is possible that two *selective processes* have operated in a way to distort both extremes of the curve. The reason that the idiots are so few may be due to the fact that the higher grade epileptics have received preference in admission to the institution. The introduction of a constant factor of this sort would skew the frequency curve in the direction of the upper limit. This tendency would probably stop short, however, before it reached the extreme end of the curve, because it is also probable that the highest grade of epileptics from the better social classes are very rarely found in State institutions. We shall not be able to settle this point definitely until other institutions have prosecuted similar studies on a larger scale.

In spite of these elements of uncertainty, the above facts seem to warrant three general conclusions: First, that the great mass of epileptics (possibly from 85 to 90%) fall below the feeble-minded line—just how much inferior the higher grade epileptics are to those persons taken at random in the general

population whose schooling and training are about of the same character we shall be in no position to say until comparative studies by identical methods have been made; second, that they do not fall below this line to such an extent as the amented feeble-minded class; and third, that the curves of distribution differ markedly for the two classes, a fact to which we shall now direct attention.

One of the significant traits of the epileptic curve is its decidedly *skewed* or *anomalous* character, noticeable particularly between Ages VIII and XI. The curve presents a marked contrast to the curve of feeble-mindedness in respect to its frequency surface. The latter curve is characterized by a fairly uniform rise up to and including Age VII, and by a rapid and uniform fall after Age VIII. It has more or less of the normal bell-shaped appearance. But in the epileptic curve there are two irregular drops in the ascending portion, a minor at V and a major at IX. The former does not possess much significance because of the small number of subjects tested in the lower ages. It may be regarded merely as a fortuitous phenomenon. But in a typical curve of frequency the rise from Age VI would have continued without any marked break at IX to the apex at X. It is apparent, therefore, that those accidental factors which normally operate to produce an unskewed or bell-shaped curve of frequency were rendered more or less inoperative in our testing by some constant factor or factors. These factors may reside in the method of giving the tests, in the method of scoring, in the defective nature or arrangement of the tests themselves, in the peculiar mental organization of the epileptic (either as a result of inborn constitu-

tion or as a result of the disorganizing processes of the disease), or in the averaging of the results for both defective children and defective adults. For example: We find 24.9% of the epileptics grading X years old, as against 8.4% grading IX years old; hence, either there must be certain defects in the mentality of epileptics at the IX-year level, or we must consider the X-year-old tests as normally too easy, or the IX-year tests as too difficult, or otherwise some factor extraneous to the tests themselves has been operative.

In order to arrive at a correct explanation of the skews in our epileptic curve we shall, in Chapter II, undertake a minute analysis of the data.

CHAPTER II.

TESTING THE BINET-SIMON TESTS: AN EXEMPLIFICATION OF AN ADEQUATE METHOD OF ANALYSIS.

In the preceding chapter we noted the approximate conformity of the *feeble-minded* curve to the normal probability surface, and the skewed character, or the distinct divergence of the *epileptic* curve from the bell-shaped distribution which would, on the theory of probability, be expected from the testing of a homogeneous group of individuals. If the skews cannot be shown to be due to the *method of scoring,* or the *method of testing,* or the *combining* of the records of juvenile and adult epileptics, they must be ascribed to *fundamental peculiarities or anomalies in the mental make-up of the epileptic.* The epileptic is not only retarded, and thus somewhat like other amented or demented individuals, but his mental mechanisms are so irregular, atypical or deviating (shown particularly by the ability which he frequently manifests to pass tests in many higher age-levels) that he is apparently qualitatively different from his first cousin, the feeble-minded person. But the law of parsimony requires one to make every legitimate effort to explain the peculiarities in the epileptic curve by the *lesser* causes before ascribing them to inherent abnormalities in the epileptic mind, so that I shall begin my analysis by an examination of the method of testing and the method of scoring.

I tried, of course, in testing, to conform as closely as possible to the instructions laid down by the authors (Binet-Simon), and particularly to the syllabus prepared by Goddard. Having worked in Goddard's laboratory, I was in a position to follow the methods in use in Vineland. In one rather important detail, however, my testing differed from the Vineland procedure: I employed a *wide-range* method of testing; that is, instead of confining the testing of the patients to the ages *immediately beneath or above* the ages in which they graded, I tested the majority *throughout the greater part of the scale.* This was done, not merely to arrive at a more complete clinical picture—to reveal the peculiar mental lapses, gaps and remnants, the presence of which may be assumed to characterize degenerative or involution changes—but in order to test the reliability of the scale itself. For the latter purpose nothing but a wide-range survey will suffice.[1]

This method of testing gave rise to a rather serious complication in the matter of scoring, for it sometimes happened that a subject might, say, pass all the ages up to and including Age V, fail on Ages VI, VII, VIII and IX, but pass Age X and also a few individual tests in the ages beyond X. It is evident that a record of this kind would admit of a two- or three-fold basis of scoring: we might use as the *basis* of scoring either *Age V, plus advance credits* from Ages VI to XII or XIII, or *Age X, plus advance credits,* or we might use the average of the ratings from these two methods. Age V would be regarded as the *first* or *lowest* age, beginning below, which was

[1]Such a survey must be made, of course, primarily on large masses of normal children.

successfully passed, and Age X as the *last* or *highest* age successfully passed.[1]

In case the basis of grading were the *first* or *lowest age successfully passed,* this process of wide-range testing would create marked discrepancies between the results of different investigators, because through the process of wide-range testing many patients would be able to win advance credits from higher ages, and this would enable them to reach a higher classification. At the same time it would make it possible for abnormalities to appear in the curve which would be concealed by a narrow-range system of testing. As a matter of fact, scores of our low or medium grade epileptics passed one or more tests in five, six, or even seven higher age-levels, and scores won from ten to twenty (or even more) points in advance of the first or lowest age in the scale which they were able to pass completely. It follows, therefore, that many who passed higher-age tests failed on lower-age tests. To show how extensively patients who passed some of the higher-age standards failed on the collective standard fixed for some lower level, the subjects have been classified in Table II according to two bases of rating: A, the *highest* or *last* age passed completely, plus advance credits; and B, the average of the *first* or *lowest* and the highest or last ages passed, plus advance credits in each case. To illustrate what is meant by these two methods of grading, we will suppose that a given patient passes Age X, fails on Age VI, but passes Age V, and that he passes 5 tests in VI, 5 in VII, 4 in VIII, 3 in IX, 3 in X, 2 in XI and 1 in XII. Ac-

[1]An age is "successfully passed" when *all its tests or all but one* are correctly performed.

cording to Method A, the subject would be rated as having a mentality of 10.6 years (Age X plus 3 advance points); and, according to Method B, as of 10.1 years (10.6 + 9.6[1] ÷ 2).

TABLE II.

Differences arising from Grading Patients by two Methods: A, basing the Grading on the Last (or Highest) Age in the Scale successfully passed, plus Advance Credits; and, B, on the Averages of both the First (or Lowest) and the Last (or Highest) Ages successfully passed, plus Advance Credits in each case.

Method.	Age.	Boys.	Girls.	Children.	Men.	Women.	Adults.	Entire population.
		%	%	%	%	%	%	%
A	IX	8.9	7.0	8.1	8.7	8.3	8.5	8.4
B	IX	12.0	11.6	11.8	19.0	16.6	17.8	14.8
D		—3.1	—4.6	—3.7	—10.3	—8.3	—9.3	—6.4
A	X	23.8	18.6	21.8	23.4	29.6	26.5	24.9
B	X	22.4	16.3	19.3	16.5	23.1	19.8	19.5
D		1.4	2.3	1.5	6.9	6.5	6.7	5.4
A	XI	8.9	4.6	7.3	13.0	4.6	8.8	8.4
B	XI	7.4	2.3	4.8	13.0	4.6	8.8	6.8
D		1.5	2.3	2.5	0.0	0.0	0.0	1.6
A	XII	3.0	2.3	2.6	4.3	2.7	3.5	3.0
B	XII	3.0	2.3	2.6	5.2	4.6	4.9	3.7
D		0.0	0.0	0.0	— .9	—1.9	—1.4	— .7
A	XIII	3.0		1.8	7.8	6.5	7.1	5.4
B	XIII	3.0			3.4	1.8	2.6	2.7
D		0.0			4.4	4.7	4.5	2.7

A and B as above. D=difference between A and B. Minus sign indicates a smaller per cent. in a given age in the A method. It indicates a *loss* instead of a gain.

It is noteworthy that there are only 7 general averages which are identical, as against 21 which are different. Considering, first, the results for the en-

[1]Age V+23 advance points=9.6.

tire population (last column), it is seen that the differences for Ages XI and XII are small, 1.6 and .7%, respectively, while they are quite material for Ages IX, X and XIII, namely, 6.4, 5.4 and 2.7%, respectively. The result of basing the grading on the highest age passed, Method A, is to reduce considerably the number of IX-year-olds and slightly the number of XII-year-olds, and to increase the X-, XI- and XIII-year-olds, particularly the first and the last. (No one was credited with Age XIII who did not pass two of the tests in that age—drawing one of the diamonds was accepted as satisfactory—or who, passing Age XIII, did not pass five of the nine tests in Ages XI and XII. On this basis, 10 who passed Age XIII were rated as of Age XIII, while 12 failed. Five who failed in Age XI passed Age XII. A few passed X and XIII, but failed on XI and XII.) Below the ninth year the distribution remained the same except in three ages—Ages V and VI for girls (a difference of 2.4% in each age), and Age VIII for women (a difference of .9%). In respect to the gross grouping, the per cents. of idiots, imbeciles and child morons remain the same, but there is a diminution of adult male (4.37%) and female (4.6%) morons, and a corresponding increase of XIII-year-old adults.

In comparing the results for the children and adults it is seen that more adults than children advance from Age IX to X and from XII to XIII by the A-method. Incidentally, it may be remarked that the differences in general are greater for the adults, which would seem to indicate a greater loss of lower-age capacities as a result of epileptic degeneration. Among the children there is no difference in Ages

XII and XIII. The girls, however, profited more than the boys, losing more in IX and gaining more in X and XI—an indirect indication of the intellectual superiority of the boys (to which we shall revert later), since a larger percentage of boys were able to pass the harder tests. The difference between the men and women, on the other hand, is insignificant.

A detailed examination was made of the individual records of the children (used in the sense of all under 21 years of age), in order to determine the *amount* of the disturbance. It was quite considerable in one-third of the 103 cases studied. The grading of 70, or 68% of the 103, dropped into a lower age classification when the B-method was used—sometimes, of course, because of a difference of only one or two points. But in some cases the grading by the B-method was actually higher. This is due to the fact that some ages contain more than five tests, namely, ages VI, VII, VIII and IX. This explains in a measure why the grading remained practically the same in the two methods for the middle ages. Patients who failed to pass Age VI—and all VI-year-olds did, as we shall see—but passed Age VII, could secure a higher rating from Age V than from Age VII. Finally, the rating remained in the same age classification with the two methods in the case of 32% of the patients.

With 14, or 13%, of these subjects the difference amounted to a whole year (that is, five points) or more, namely: one year for three patients, 1.2[1] for three, 1.4 for two, 1.6 for one, 2.0 for one, 2.2 for two, and 2.4 for one.

[1]One point=.2.

The range of the possible difference of rating, due to a difference in the method of computing credits, will be seen to better advantage if we compare our first method, A, with a third method, C. Instead of using the average of the rating from the highest and lowest ages passed, as in B, let us use only the lowest age passed as the base, with advance credits as before. The difference in points thus amounts to one year or more in the case of 41, or 39% of the children, as follows:

Difference in years....	1.	1.2	1.4	1.6	1.8	2.	2.2	2.4	2.6	2.8	3.2
Number of patients...	12	6	3	6	1	2	5	1	2	2	1

The difference thus amounts to two full years or more in the case of thirteen patients—truly a significant difference. But, large as these discrepancies are, the question may still be raised why they are not yet more extreme, since some patients who fail to pass a lower level may pass sundry tests in a half-dozen or more higher ages, and all the tests in some one age (*e. g.,* Age X) three or four years higher than the lowest age satisfactorily passed. The answer is to be sought in the corrective formula (one year of advance credit for five advance points), by virtue of which subjects may gain several years from the lowest age passed. Consequently the difference between the A-method and the C-method of scoring, and particularly between the A-method and the B-method, are oftentimes quite negligible.

Since the difference in the mental station or classification of epileptics may amount to two or three years, due entirely to the particular method of grading adopted, it is evident that the results of different workers have no comparative value unless precisely

the same system is followed. Accordingly, I adhered to the plan prescribed by the authors (Binet-Simon), which is followed by the workers in this country, according to which the subjects are credited with the *highest* age passed successfully (all the tests or all but one), plus advance credits (one year for five points): in other words, I followed what I have termed Method A of scoring.

Our survey of the facts up to this point justifies the following conclusions:

(1) A difference in the method of grading may perceptibly alter the distribution of homogenous groups of patients, particularly in Ages VI, IX, X and XIII, and in the moron and retardate groups, and may thus vitiate results for comparative purposes.

(2) This difference in rating may vary from considerably less than one year to more than two years.

(3) The obvious effect of the standard method of rating, A, is to elevate the grading (except in a few of the middle ages): epileptics failing at lower levels often pass higher ages.

(4) The B.-S. Age IX is more difficult than Age X, and apparently Age XII than Age XIII, for epileptics.

(5) Although it is advisable to follow the Binet-Simon method of accrediting (adding advance points to the *highest age passed*), it is obvious that when very large percentages of homogenous groups fail at certain lower levels while passing a higher level we have strong presumptive evidence that we are dealing either with special, aberrant or deviating groups of individuals, or with an unsatisfactory construction or arrangement of the tests. A variation

of two years and more must point to inherent defects in the scale, or fundamental abnormalities or departures in the mental organization of the subjects tested.

(6) Finally, so far as concerns our fundamental query, it is possible that both the wide-range method of *testing* and the method of *grading* may *partly* account for our skewed epileptic curve. For example, the A-method of scoring decreased the per cent. of IX-year-olds about 6.5% and increased the number of X- (particularly) and the number of XIII-year-olds, as may be seen from Table II. Likewise, it is seen from Table III that, while 90% of those grading IX passed this standard by virtue of *advance* credits, 94% of those who grade X passed the tests of that age. Accordingly, the skew in the curve at X—and this is the most obvious skew—is independent of the method of scoring. So far as concerns our present purpose, the method of *scoring* may, therefore, probably be neglected, more particularly because it has conformed with the prevailing usage, thus rendering the results comparable with the findings of other investigators. Consequently it will be necessary to study more closely the *wide-range* method of *testing*.

TABLE III.

Table Showing the Percentages of Epileptics in each B.-S. Age who successfully passed the Age in which they were Classified and the Percentages who also passed the next lower Ages. Thus: of the VII-year old epileptics, 95% passed the Vth-year standard, and 11% the VIth-year standard. Only 13% passed the VIIth-year standard, so that the large majority of the VII-year olds qualified on the basis of credits from higher ages.

Percentage Passing B.-S. Ages Indicated.

B.-S.	II		III		IV		V		VI		VII		VIII		IX		X		XI		XII		XIII	
Classification.	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Age III	2	100	4	75	4	00	4	00	4	00	3	00												
Age IV			4	75	7	71	4	00	4	00	3	00												
Age V					4	100	7	28	4	00	4	00	3	00			3	00						
Age VI					8	87	16	87	18	00	14	14	7	00	3	00	4	00						
Age VII							23	95	27	11	23	13	21	00	20	00	15	00						
Age VIII							29	100	49	26	46	43	46	29	44	00	42	09	3	00	3	00	2	00
Age IX							5	100	22	58	25	80	29	70	22	10	22	00	6	00	9	00	5	00
Age X									62	64	40	77	67	82	75	18	74	94	33	00	24	00	17	03
Age XI									4	75	4	75	21	100	24	46	24	95	22	41	19	00	17	29
Age XII											4	100	7	85	10	70	11	100	10	30	11	64	10	30
Age XIII													3	100	8	75	10	100	11	81	11	63	11	100

N.—number of patients affording the basis for each array. Total number of patients included in tabulation: 159 males and 117 females. Basis of accrediting: method A of Table II, as explained in the test.

The importance of this factor may be seen by referring to Table III, which shows that in not more than five ages (III, IV, X, XII, XIII) did more than 60% of the patients successfully pass the ages in which they classify. The ages which make the worst showing are VI, VII and IX, particularly VI and IX, which proved veritable *pontes asinorum.* It follows that the age classification of the majority of the epileptics was attained on the basis of *advance points.* Very few, except in Age X, passed all but one of the tests of the mental age assigned them. It is therefore apparent that any B.-S. testing which is confined to the subject's chronological age or to the age immediately above or below is of questionable value, if not worthless, and is positively pernicious to the interests of scientific research either for purposes of *diagnosis* or *classification* or the *testing* of the scale.

To what extent, then, is the wide-range testing responsible for our peculiar curve of distribution? Owing to the present inaccessibility of the original records, I cannot answer this question in exact numerical terms. But the two following considerations would seem to indicate that the method of *testing* is of secondary consequence.

First, it is probable that other examiners (particularly the Vineland workers, with whose results our curve has been contrasted) have made a practice of testing the mentality of the examinees at least *two years above* the station in which they grade (since the basis of rating has been uniformly the *highest* age passed, the testing of lower ages can be entirely ignored). In case this is granted — other writers have been silent on this point—the fundamental question reduces merely to one of the *relative*

amount of the advance credits given—the difference in the number of credits which may be gained by testing only two years above the age fully passed or by testing in a considerable number of ages. While we have found numerous epileptics whose capacities have ranged throughout the larger part of the scale, the successes higher up have usually been sporadic and exceptional, so that it is entirely probable that the great majority of the advance credits given the epileptics have come from the *two adjacent higher ages*. If this is so, the peculiarities in the curve cannot be due primarily to the wide-range testing.

Second, while the system of advance crediting from a wide-range testing effectually conceals the skew which should have appeared in the curve at Age VI, it is only very slightly responsible for the skew at Age X, because 94% of those who grade X pass the standard for this age, while 84% of them fail on the IX-year tests. Not only so; an examination of the feeble-minded classification shows that the most obvious break occurs in the ninth standard.

It is thus apparent that if further analysis reveals other significant factors, as implied in the foregoing statements, the methods of scoring and wide-range testing must be given a subordinate place. There are three methods which we may employ for a further critical examination of the data:

TABLE IV.

Percentage of Epileptic Children Passing Each Individual Binet-Simon Test, irrespective of the Age in which the Children are Classified

	B.-S. Test.	Boys No.	Boys %	Boys Range.	Girls No.	Girls %	Girls Range.	Both Sexes No.	Both Sexes Ave. %	Ave. Range.	Aves., Each Age. Boys. %	Aves., Each Age. Girls. %	Aves., Each Age. Both Sexes. %
I.	1	11	100		7	85		18	94				
	2	11	90		6	66		17	82				
	3	11	81	19	6	50	35	17	70	24	90	67	82
II.	4	12	41		7	57		19	47				
	5	9	33		6	00		15	20				
	6	12	58	25	6	83	83	18	66	46	44	46	44
III.	7	17	61		14	78		31	70				
	8	15	33		17	64		32	50				
	9	18	66		17	82		35	74				
	10	60	90		40	95		100	92				
	11	60	91	58	42	97	33	102	94	44	68	83	76
IV.	12	23	69		18	83		41	75				
	13	23	65		19	68		42	66				
	14	29	83		28	71		57	77				
	15	20	75	18	19	68	15	39	71	11	73	72	72
V.	16	25	64		25	68		50	66				
	17	21	62		24	70		45	66				
	18	52	60		37	51		89	56				
	19	43	88	28	35	91	40	78	89	33	68	70	69
VI.	20	26	65		30	70		56	67				
	21	43	14		38	10		81	10				
	22	27	60		31	58		58	59				
	23	47	79		36	63		83	72				
	24	27	36		29	51		56	43				
	25	54	44		38	36		92	41				
	26	30	60	65	32	68	60	62	64	62	51	51	51
VII.	27	39	61		35	77		74	68				
	28	36	75		30	66		66	71				
	29	28	68		28	71		56	69				
	30	45	66		34	44		79	57				
	31	47	42		40	42		87	42				
	32	48	64		38	47		86	56				
	33	36	80		33	69		69	75				
	34	46	75	38	34	55	35	80	67	43	66	59	63
VIII.	35	47	72		33	59		80	66				
	36	47	66		34	44		81	56				
	37	51	57		37	64		88	60				
	38	39	54		29	34		68	45				
	39	45	51		30	60		75	54				
	40	38	73	22	28	57	30	66	66	21	62	53	58
IX.	41	47	64		36	38		83	53				
	42	45	82		36	55		81	70				
	43	44	43		29	17		73	33				
	44	45	17		30	10		75	14				
	45	47	34		30	10		77	23				
	46	45	40	65	29	20	45	74	31	56	46	25	37
X.	47	45	51		31	48		76	49				
	48	49	79		35	48		84	66				
	49	40	52		29	34		69	45				
	50	44	38	41	29	34	14	73	36	30	55	41	49
XI.	51	33	36		19	21		52	30				
	52	33	42		21	33		54	40				
	53	39	10		26	19		65	13				
	54	33	12		17	23		50	16				
	55	29	14	32	15	06	27	44	11	29	23	20	22
XII.	56	31	00		23	17		54	07				
	57	34	61		19	57		53	59				
	58	33	03		20	00		53	02				
	59	30	20	61	14	14	57	44	18	57	21	22	21
XIII.	60	29	34		14	14		43	29				
	61	29	10		11	18		40	12				
	62	17	00	34	5	00	18	22	00	29	15	11	14
Ave				39			38			37			

B.-S. Test: the tests are numbered consecutively, following the customary order (See Form I of the Skillman blanks).

No.=number tested. %=per cent. of successes. Range=difference between the highest and lowest per cents. in each age. Aves. for each age represent the sum of all the tests in each age, divided by the number of tests.

The above includes all the epileptic children except nine. It includes four boys who had been free from attacks for over two years.

(1) We may determine the *percentage of successes* (passing) for each individual test of the entire scale for a given group of examinees, *irrespective* of the *ages* in which the examinees *classify*. Such a tabulation for all the epileptic children (all under 21) appears in Table IV. The records for the adults are not now available, but the curves for the children and the adults, in spite of various interesting differences, have the same *general* characteristics (Table I). As will be seen from Columns 2 and 5, Table IV, the number of children put through each test differs considerably, but the percentages of successes are in all cases based upon the number examined for the given test.

(2) We may determine the *per cent. of successes* in each *individual test,* based only on the records of those subjects who *classify in the age* to which the test has been assigned. That is to say, we determine what percentage of patients who grade VI pass each one of the VI-year tests, what per cent. of the VII-year-olds pass each of the eight tests of that age, etc. With this object in view, the data for the children have been retabulated in Table V. If the tests in each age are relatively equi-difficult, the successes should be approximately equal for the different tests of the same age. This method could be extended so as to include a determination of the per cent. of successes for each test in both *lower* and *higher ages.* What per cent. of subjects who grade V, VI or VII pass each of the tests in Age III or IV?

TABLE V.

Percentages of Children Passing the Individual Tests in the Binet-Simon Ages in which they are Graded.

	AGES I AND II.							AGE III.						
	Boys			Girls			Both Sexes.	Boys			Girls			Both Sexes.
Test.	No.	%	M.V.	No.	%	M.V.	% M.V.	Test.	No.	%	M.V.	No.	%	M.V.	% M.V.
1....	7	100		2	100		100	7....	4	100		3	33		71
2....		100			100		100	8....		00			66		26
3....		83			50		75	9....		100			66		85
4....		43			50		58	10....		100			66		85
5....		28			00		22	11....		100			100		100
6....		28			50		33								
Ave..		63	.30		58	.27	64 .27	Ave..		80	.32		66	.13	73 .20
		AGE IV.								AGE V.					
12....	5	100		4	100		100	16....	1	100		2	50		66
13....		100			75		88	17....		00			100		66
14....		60			75		66	18....		00			50		33
15....		80			25		55	19....		100			50		66
Ave..		85	.15		68	.22	77 .17	Ave..		50	.50		62	.17	58 .12
		AGE VI.								AGE VII.					
20....	4	50		6	66		60	27....	5	80		6	100		90
21....		00			00		00	28....		60			100		82
22....		75			50		60	29....		100			100		100
23....		50			50		50	30....		40			33		36
24....		25			66		50	31....		40			16		27
25....		25		5	00		10	32....		60			33		45
26....		75			66		70	33....		80			100		90
								34....		80			66		72
Ave..		42	.16		42	.12	42 .13	Ave..		67	.17		68	.31	67 .24
		AGE VIII.								AGE IX.					
35....	9	66		6	66		66	41....	6	100		3	66		88
36....		55			50		53	42....		100			100		100
37....		44			100		66	43....		50			33		44
38....		55			33		46	44....		16			00		11
39....		11			66		33	45....		33		2	00		22
40....		77			66		73	46....		33			66		44
Ave..		51	.16		63	.14	56 .12	Ave..		55	.29		44	.33	51 .28
		AGE X.								AGE XI.					
47....	16	93		8	87		88	51....	6	50		2	50		50
48....		100			75		91	52....		66			100		75
49....		87			75		83	53....		33			50		37
50....		68			87		75	54....		33			50		37
								55....		33			00		25
Ave..		87	.09		81	.06	84 .05	Ave..		43	.12		50	.20	45 .14
		AGE XII.								AGE XIII.					
56....	2	50		1	100		66	60....		100					
57....		50			100		66	61....		100					
58....		50			00		33	62....		50					
59....		50			100		66								
Ave..		50	.00		75	.37	58 .12	Ave..		83	.22				

Test=number of individual B.-S. test. No.=number of patients examined. M. V.=mean variation (between the different subjects' scores based on the figures given in the per cent. columns).

Average M. V.'s for all ages, except XIII: boys, .20; girls, .21; both sexes, .17.

Average per cents. for all ages, except XIII: boys, .61; girls, .61.

(3) We may determine what percentage of patients classifying in a given *higher* age, say VIII, IX or X, fail to pass any of the *lower age-norms* (not *individual* tests, but the *age standards*). For example, how many X-year-olds do not pass Age VI? This throws light on the *collective* difficulty of the tests of various ages. For this study we have two sets of data, one incomplete and the other complete. The incomplete data for 276 juvenile and adult epileptics, Table III, were originally gathered for another purpose, namely, the determination of the per cent. of patients who passed ages immediately adjacent to that in which they classified. No record was made of the ages in which they did not pass any tests at all; however, for some of the patients the data cover more than the years contemplated. This explains why the per cents. in some cases are based on many subjects, but in other cases on only a few. Moreover, data based on only a few cases have not always been tabulated. In the absence of the original records, these defects cannot now be remedied. But, in spite of these defects, a comparison of the ages in Tables VI and III, which are comparable, indicates that the data are sufficiently reliable for our purpose. In Table VI we have in complete form for the entire population of the institution the percentage of patients between the B.-S. Ages of IX and XIII who pass Age IX and the per cent. of those between Ages VI and X who pass Age VI.

What, now, does a critical examination of our tables reveal?

TABLE VI.

Percentage of Epileptics Grading from IX to XIII who pass the B.-S. Standard for Age IX.

B.-S.	Boys.		Girls.		Both Sexes.		Men.		Women.		Adults.		Males.		Females.		Entire Population.	
Age.	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
IX	6	16	3	33	9	22	10	10	9	00	19	05	16	12	12	08	28	10
X	16	37	8	00	24	25	27	15	32	12	59	13	43	23	40	10	83	16
XI	6	82	2	00	8	62	15	20	5	00	20	15	21	38	7	00	28	28
XII	2	100	1	100	3	100	5	60	3	66	8	62	7	71	4	75	11	72
XIII	2	100				50	9	66	7	85	16	75	11	72	7	85	18	78
Ave.		67		33		51		34		32		34		43		23[1]		40

Percentage of Epileptics Grading from VI to X who pass the B.-S. Standard for Age VI.

VI	4	00	6	00	10	00	7	00	5	00	12	00	11	00	11	00	22	00
VII	5	00	6	33	11	18	9	00	12	00	21	00	14	00	18	11	32	06
VIII	9	44	6	33	15	40	20	10	20	25	40	17	29	20	26	26	55	27
IX	5	60	3	66	8	62	10	70	9	44	19	58	15	66	12	38	27	50
X	14	78	8	87	22	81	23	65	31	48	54	55	37	70	39	56	76	63
Ave.		36		43		49		29		23		26		31		26		29

Age, the age in which the patients grade. No., number of patients included in the average (including those who pass and fail). %, per cent. passing. This includes all who did not fail in more than one test in each age.

[1]Exclusive of 85% in Age XIII.

In Table IV we find a surprisingly large variation in the difficulty of the individual tests, both for the boys and the girls, ranging from 100% (first test, Age I, boys) to 0% of successes. Since this variation is between tests occurring in *any part of the scale,* it is significant only because of its extreme character, for a large variation will inevitably occur when subjects of very varying capacities are tested throughout a large part of a graded scale and the results are thrown together. The more stupid will necessarily fail on all the higher tests, and the brighter will succeed on all the lower ones. Hence, all that could be demanded, at the utmost, is that the *lower-grade* subjects find the high-grade tests in the *same ages* about *equally difficult,* and the *high-grade* subjects the tests in the same lower ages about *equally easy.* Accordingly, we are justified in comparing only the tests of the same ages. Assuming that these are fairly uniform in difficulty, the percentage of fail-

ures should be approximately the same for all the tests of the same age.

It is patent from a cursory glance at Table IV, however, that there is a wide difference between the tests. This is seen most rapidly by comparing the "range" columns. The range between the highest and lowest per cent. of successes in each age averages 37% for the thirteen years. The general averages are practically the same for the boys and the girls, although there are striking differences for some of the ages. The largest range is between the tests of Age VI, 62%; XII, 57%, and IX, 56%; and the smallest between Ages IV, 11%; VIII, 21%, and I, 24%. The order differs somewhat, however, for the boys and the girls, the largest range for the boys being in Ages VI, IX and XII, and for the girls in II, VI and XII, in the order given. The smallest are in Ages IV, I and VIII for the boys, and X, IV and XIII for the girls.

If we now regard the *collective* (average) difficulty of tests of the same ages, we again find a very considerable variation. The most difficult ages are XIII (14% of successes), XII (21%), XI (22%) and IX (37%), and the easiest I (82%), III (76%), IV (72%) and V (69%). The order is the same for the boys and girls considered separately, except that II displaces IX for the boys in the difficult set, and III and IV exchange places in the easy series. The averages for the boys and girls are not appreciably different, except in Ages I, III, VIII, IX and X.

It is evident, however, from what has been said that averaging the per cent. of successes by ages in this fashion (last three columns of Table IV) is valuable chiefly for purposes of comparing the *relative*

efficiencies of the sexes in the same ages, and not primarily for the purpose of comparing the difficulty of the various ages. The method is faulty for the latter purpose, particularly as affects the extreme ages in the scale, because, since the patients were tested throughout a large extent of the scale, some comparatively high-grade subjects were tested on the lower tests, while, *vice versa,* some low-grade subjects were tested in the higher ages. The tendency, therefore, is to decrease the real difficulty of the lower ages and to increase that of the upper ages. This, indeed, the results show. If, therefore, we confine the comparison to the *middle range* of the scale, V to IX, inclusive, where these tendencies may neutralize one another, we find that *Ages IX and VI are the most difficult, followed by VIII, VII and V* (decreasing order). This conforms substantially with the data in Tables V and VII, to which we now turn.

The latter enable us to make a more reliable comparison between the difficulties of the *different tests of the same age,* and indirectly between the *relative collective difficulty of the different ages,* for here, as explained, the per cents. of successes for a given test are based on the testing of those subjects only who classify in the age in which the test has been placed.

The variation between the different tests of the same age appears most readily from an examination of the M. V. and "range" columns. The average M. V. for all ages amounts to .17, a very considerable fraction of the size of the average per cents. (.61). It is practically the same for the boys and the girls, although there is considerable difference in a few of the ages.

TABLE VII.

Ranges between the Highest and the Lowest per cents. of successes recorded for the tests of each Age in Table V.

Ages	I & II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.
Boys	72	100	40	100	72	60	66	84	32	33	00	50
Girls	100	67	72	50	66	84	67	100	12	100	100	
Children .	78	74	45	33	70	73	40	89	16	50	33	

The general averages for all Ages, except XIII, are as follows: boys, 60%; girls, 74%; both sexes, 54%.

The M. V. amounts to more than .25 in seven cases: Ages I-II, boys and girls; III, boys; VII, girls; IX, boys and girls; and XII, girls (exclusive of Age V, boys). The *ranges* (Table VII) are also very large for these ages, the seven largest ranges being in Ages I-II, boys; III, boys; VII, girls; IX, boys and girls; XI, girls; and XII, girls. Five of these amount to 1.00 and two to .84. The average of the ranges for the years I to XII, inclusive, reaches the very considerable sum of .54. It is somewhat larger for the girls than the boys.

On the other hand, considering the *minimal* variations, we find the M. V. to be less than .17 in the following ages: III, girls; IV, boys; VI, boys and girls; VIII, boys and girls; X, boys and girls; XII, boys. In some of these ages we also find, correspondingly, the smallest ranges, namely, Ages IV, boys; X, boys and girls; XI, boys; XII, boys and girls. The smallest range comes in Age X.

If we consider only the general averages (the averages for the two sexes), the *largest M. V.'s* (from .20 to .28) are in the following ages: I-II, III, VII and IX, and the largest ranges in Ages I-II, III, VII and IX. *The smallest M. V.'s* (from .14 to .05) are in the following ages: V, VI, VIII, X, XI and XII,

and the smallest ranges in the following: V, VIII, X and XII.

Summarizing these results, it appears that, if we exclude Ages I-II as representing two years rather than one, the greatest variation occurs between the tests of Ages III, VII, and particularly IX, and that the greatest uniformity obtains in VIII, X (distinctly), XI and XII (less decidedly in IV and VI).

The question now naturally arises whether the *collective* difficulty (*average* per cent. of successes for *all* the tests of a given age) is greatest for the most *variable* age-norms. Reference may be made to three tables to obtain light on this question. On the basis of the average per cents. in Table V, there appears to be no correlation. The group average for Ages III, VII and IX is .64 (.66 for boys and .59 for girls), and for Ages X, XI, XII, IV and VI .61 (practically the same for the boys and the girls). The per cents. in Table V, however, do not represent the number of patients who passed the age-norms, as in Table III. In the latter table the successes (32%) for the group of variable age-norms are appreciably less than for the group with more uniform tests (49%). It is noteworthy that the successes are above 63% in three ages (IV, X and XII) where the variation is small, and in only one age where the variation is large (Age III), and that the successes are surprisingly small in the remaining two ages having unequal tests (VII and IX. Cf. also Table VI). In the case of Age VI, however, the variation is small, although this is a very difficult age (Tables III and VI).

It is therefore apparent that *there is a greater variation between the tests of a difficult than an easy*

age-standard, although this need not always be so. If the tests of a given age are uniformly difficult, the variation will be small, and the same is true, of course, if they are uniformly easy. But they are more liable to be uniformly easy than uniformly difficult.

The most striking result which our analysis of the M. V.'s and ranges for the ages has thus far shown is the amazing *lack of uniformity between the difficulty of the tests of the same age-norms for fully half of the ages of the scale*—amazing from the standpoint of the precision demanded by the standards of scientific work. Moreover, we have also seen that the *collective difficulty* of different *age-standards* differs—to how great an extent may be seen by a re-examination of Tables III and VI. The per cents. of passing range from .00 to 100%. (The latter may be ignored, as it is for the final age in the scale, and all who passed this standard could only do so by virtue of the tests of this standard itself). The successes exceed 70% in only four ages (III, IV, X and XIII), and reach less than 42% in six ages (V, VI, VII, VIII, IX and XI). *The most difficult age-norms are VI* (00% *of passing*), *IX* (10%) *and VII* (13%); *and the easiest III* (.73%), *X* (84%), *XII* (58%), *and XIII* (100%). The last age may be neglected for the reason given, and III and XII because of the fewness of the subject tested in these ages. We thus obtain for epileptics *one specially easy age-standard, X, and several specially difficult age-standards.* In order to study more thoroughly the two most difficult ages, VI and IX, the data for the juvenile and adult epileptics were retabulated as appears in Table VI (which see).

With this surprisingly wide range in the difficulty of the Binet-Simon age-norms demonstrated, we are forced to meet a fundamental question, namely: In order that a measuring scale of intelligence shall approximate the character of scientific measures, *what amount of variation in the difficulty of the tests of the same age shall be considered as the maximal permissible?* What percentage of normal children should pass the tests designated as criteria of their chronological ages in order that the tests shall constitute scientific standards for these ages? It is evident that if only a small per cent. of typical children pass the standard tests the latter are worthless. It is equally evident that 100% of passing is also out of the question, because normal children will differ considerably in various traits and capacities, some being strong in one trait and some strong in another. We may thus regard as perfectly normal a certain amount of variation in the capacities of children of the same ages and training. Moreover, mental measurements are variables, and not absolute constants. Consequently the standards of each age must consist of a *number of tests,* sufficiently comprehensive to survey a variety of fundamental mental traits and capacities. And the difficulty of these tests (and the scoring) must be so adjusted that, while one test may be too hard for one child and another too easy, the majority of children should be able to pass the *collective standard, i. e.,* their *age-norm.* To be more specific, I should hold that *if 75% of normal (so-called) children fail to pass their age-norms, the norms are too difficult.* Some of the tests must be transposed or eliminated.

On the basis of this standard, it appears that *only*

two age-norms are properly constructed, so far as the testing of the epileptics is concerned, namely, III and X (Age IV falls short by 4%). Half of the ages do not even approximately satisfy the requirements. In fact, we may lay down this rule: that *epileptics do not qualify for a given age on the basis of satisfying the requirements of that age, but on the basis of the system of advance credits from higher ages.*

To what, then, are the demonstrably large variations in the difficulty of the various Binet-Simon age-norms due? Are they due primarily to inherent defects in, and misplacements of, the tests themselves—defective horizontal and vertical arrangement—or to fundamental deviations or abnormalities in the epileptic mind? To answer this question satisfactorily we must still ascertain what particular tests produced the greatest 'mortality'—were too difficult—and what particular tests were too easy. More than that, we must determine whether the tests found too difficult or too easy for epileptics have likewise been found too difficult or too easy for normal children or normal adults.

A comparison of Tables IV and V (omitting Ages I, II and XIII, on account of the insufficiency of the data) indicates that the following tests were *distinctly too difficult* for epileptics:

Age V, arranging triangular pieces into a rectangle;[1] VI, repeating 16 syllables,[2] executing three commissions, and knowledge of own age; VII, repeating five numbers, drawing a diamond, and de-

[1]The success for this test is high in Table IV, because it was given to an unusually large number of high-grade subjects.

[2]Namely: "We get up in the morning, eat, work and play, and then go to bed." (Variant forms infrequently employed.)

scribing actions; VIII, counting backward and copying from dictation; IX, descriptive or classificatory definition, six memories, giving correct change (25c.—9, or 8 or 7c.), and arranging six weights; XI, arranging shuffled words into a sentence, essential ideas in abstract definitions, and uttering 60 words; XII, repeating 26 syllables,[1] and inferring facts from given circumstances; and XIII, all tests. In all except one of the above tests the per cent. of successes is less than 50; in most of them decidedly less. The failures for the higher ages are not brought out properly in the tables because of the form of the tabulation and because of the fewness of the subjects tested.

While the tables are not so constructed as to indicate which tests are *too easy* (passed in lower ages), I came to feel that the following should probably be so regarded: Age V, counting 4 pennies; VII, number of fingers on hands, and counting 13 pennies; IX, naming days of week in order; X, naming moneys; and XII, giving rhymes.

Since the above was written, the results of Katherine Johnston's,[2] Goddard's[3] and Bobertag's[4] testing of *public-school children* have, opportunely, ap-

[1]Namely: "The other day I saw in the street a pretty dog who carried in his mouth a basket of strawberries." (No variants used.)

[2]Katherine L. Johnston, M. Binet's Method for the Measurement of Intelligence.—Some Results, *The Journal of Experimental Pedagogy*, 1: 1911, 24ff.

[3]Henry Herbert Goddard, Two Thousand Normal Children Measured by the Binet Measuring Scale of Intelligence, *Pedagogical Seminary*, 18: 1911, p. 232f.

[4]Otto Bobertag, Ueber Intelligenzprüfungen (nach der Methode von Binet und Simon), *Zeitsch. für angewandte Psychologie*, 5: 1911, 105ff.

peared. These, with other results already available,[1] will better enable us to explain the inequalities which we have found in the scale.

Miss Johnston tested a mixed group of 193 elementary, and 25 high-school girls in Sheffield, England; Goddard's assistants tested the entire school population (1547) of the first six grades of a New Jersey school system, and Bobertag tested 435 regular and special pupils in the schools of Breslau. The former followed essentially Binet's latest (1911) revision, while Goddard, Bobertag (with certain exceptions) and I followed the 1908 series.

All three of these studies confirm some of my suspicions with respect to the accuracy of the scale. Johnston refers to one girl who did 15 and another 23 tests superior to the age in which she classified, but she does not give averages, nor any intimation as to how frequently this happened. It is, as we have seen, a frequent phenomenon among epileptics. We need to know to what extent it appears with normals before we can generalize unequivocally about abnormals. She, too, found pupils who, unable to satisfy an inferior age standard, passed higher

[1]The following studies or discussions have appeared too late to receive notice in the present discussion:

J. C. Bell. Recent Literature on the Binet Tests, *The Journal of Educational Psychology*, 3: 1912, 101ff.

Lewis M. Terman and H. G. Childs. A Tentative Revision and Extension of the Binet-Simon Measuring Scale of Intelligence, *The Journal of Educational Psychology*, 3: 1912, 61ff, 133ff, 198ff.

Edmund B. Huey. The Present Status of the Binet Scale of Tests for the Measurement of Intelligence, *Psychological Bulletin*, 9: 1912, 160 (a review of the literature).

F. Kuhlmann. The Present Status of the Binet and Simon Tests of the Intelligence of Children, *Journal of Psycho-Asthenics*, 16: 1912, No. 3.

An abridged discussion of the relevancy of the scale will be found in: J. E. Wallace Wallin. The Present Status of the Binet-Simon Graded Tests of Intelligence, *The Alienist and Neurologist*, 33: 1912, May.

ones, but no figures are given to show how frequently this happened. She also found obvious inequalities in the difficulty of the age-norms. Her records show that of 30 9-year-old girls only one satisfied the IX-year norm, as against 24 who failed and 5 who passed Age X. Of 41 7-year-olds, 6 passed their standard, as against 26 who failed and 9 who passed Age VIII. Of 22 8-year-olds, 7 passed, 15 failed and 6 "went above" VIII. Of 38 10-year-olds, 12 passed and 26 failed. Of 24 12-year-olds, 5 pased, 18 failed and one passed Age XV. These figures indicate that there is a wide divergence in the difficulty of the tests of the same age, and that, *with normal* (*sic*) *English girls, the standards are too difficult, as a rule:* there are more who fail than reach their age-norms. The most difficult age-norm, according to Miss Johnston, was Age IX. These conclusions, it must be remembered, refer to the latest, or 1911, arrangement of the B.-S. tests.

An examination of Goddard's table (Table I) shows that there were more 6-year-olds who could satisfy the VII- than the VI-year norms (69 against 48); that a larger number of 8-year-olds stayed in Age VII than passed Age VIII (87 vs. 86); that very few of the 8-year-olds were able to satisfy the IX-year tests (only 16, as against 86 for the VIII-year norms), but there were actually more 9-year-olds who could pass the X- than the IX-year norms (58 compared with 56); that an unusually large number of 10-year-olds qualified for their standard, while an appreciably smaller percentage of 11-year-olds qualified for the XI-year standard; and that more 12-year-olds classified as X than as XII (42 vs. 39). The results of both of these studies of pub-

lic school children (Bobertag gives results only for the individual tests) accordingly *confirm my findings,* based only on the results of those epileptics who grade in the various Binet-Simon ages considered, *particularly in respect to the disproportionate difficulty of Ages VI and IX and the disproportionate ease of Age X* (Miss Johnston's data, it should be said, to avert misapprehension, are based on too few cases for Age VI). It is obvious that we must conclude that there is a *faulty vertical arrangement of the tests in the scale as at present constituted.*

No only so: our findings in respect to the *individual* tests are also confirmed, at least in part, as shown in Table VIII for the tests which I came to view with most suspicion. In this table the conclusions of Decroly and Degand, Binet's 1911 revision, and Johnston's, Goddard's, Bobertag's and my own findings are compared. The Skillman figures are based on Table V. Table VIII may thus advantageously be studied with respect to our fundamental inquiry: Does the testing of normal (so-called) children show that our anomalous results are due to defects in the construction of the scale or to the peculiar mental organization of the epileptic?

A study of Table VIII shows, in harmony with our findings, that *the following tests* (with certain obvious discrepancies) *are too difficult:* Age V: rearranging triangles, by G. (Goddard) and Bo. (Bobertag). B. (Binet) retains the test, however, in Age V. VI: repeating 16 syllables, by G. (15% of successes). B. omits the test. VII: repetition of five numbers, by J. (Johnston) and B., who elevates the test to Age VIII, as does G., though his own per cent. of suc-

cesses in VII (74%) indicates that it is about right where it is. Bo. finds it properly placed. VIII: copying dictation, by G.; B., sustaining D.-D.'s (Decroly and Degand) objection (training test), omits it, but Bo. finds it rightly placed. IX: giving correct change, by G. and J., but not by Bo. (who used $100 - 20 = 80$). Definition by description, by J. and G. Arranging six weights, by J. and Bo., and apparently by B., who places it in X, while D.-D. would place it in V or VI. XII: repetition of 26 syllables, by J., G. and B., but too easy by Bo. if the sentence is simple and meaningful. XIII: all tests, by all.

TABLE VIII.

Comparison of the Results of Different Investigators on Various Apparently Misplaced B.-S. Tests.

B.-S. Age. 1908 Series.	Test.	Decroly-Degand.	Position in Binet's 1911 Revision.	Katherine Johnston's per cent. of successes.	Goddard's per cent. of successes.	Wallin's per cent. of successes.	Bobertag's per cent. of successes.
V.	Rearranging triangles..		Same.		.62[1]	.33	.30
	Counting 4 pennies.....	Training.	Same.		.88	Too easy.	Too easy.
VI.	16 syllables.....		Omitted.		.15	.00	
	3 commissions.....	Too easy.	Raised to VII.		.86	.50	Too easy.
	Own age.....	Training.	Omitted.		.81	.10	Valueless.
VII.	Number of fingers.....	Training.	Omitted.		.95	Too easy.	.90
	Diamond.....		Dropped to VI.		.92	.36	.61
	5 numbers.....		Raised to VIII.	.56[1]	.74—Raised to VIII.	.27	.77
	Describing actions.....		Same.		.76	.45	Too easy.
	13 pennies.....	Mechanical.	Dropped to VI.		.73 in VI.	Too easy.	.93
VIII.	Names 4 colors.....		Dropped to VII.		.95 in VII.	Too easy.	.89
	20 to 0.....		Same.		.83	.46	.85
	Copying dictation.....		Omitted.		.46	.33	Too easy.
IX.	Days of week.....		Omitted.		.95 in VIII.	Too easy.	.97
	Correct change.....		Same.	.46	.59	.44	.74
	Descriptive definition...	Reading.	Same.	.23	.62	.11	
	6 memories.....	Training.	Omitted.	.53	.81	.22	Correct.
	Arranging weights.....	5th or 6th year.	Raised to X.	.30	.80	.44	.60
X.	Naming moneys.....		Dropped to IX.	.50	.70 in IX.	Too easy.	Too easy.
XI.	60 words.....	Too easy.	Raised to XII.	.80[2]	.92	.37	.60
	Abstract definitions.....		Raised to XII.	.12[2]	.70	.37	.56
	Rearranging shuffled words.....		Raised to XII.	.45[2]	.80	.25	.56
XII.	26 syllables.....		Raised to XV.	.50[2]	.42	.33	Too easy.
	Rhymes.....		Raised to XV.		.90 in XI.	Too easy.	.50
	Inferring facts.....		Raised to XV.		.93	Too hard.	Too hard.
XIII.	All tests.....	Too hard.	Raised to adult.			Too hard.	

[1]Johnston's and Goddard's per cents. were computed by the writer from the figures given in the articles.
[2]These tests were given to 12-year-olds.

The following tests, contrariwise, proved to be too easy, in harmony with my results: VII: counting 13 pennies, by B., Bo. and G. D.-D. object to the test as too mechanical. VIII: naming four colors, by D.-D., B. and G. (Our VII- and VIII-year-old epileptics required 7.7 seconds, and IX-year-olds 5 seconds, to name the colors.) X: naming money, by Bo., B., who has dropped it to IX, and perhaps by G., who finds 70% of successes in IX, but retains it in X. J., however, found it too hard. XII: three rhymes, by G., but not by Bo., nor by B., who has raised it to XV (!). Counting four pennies in V, which appeared to Bo. and myself too easy, G. and B. found about right, while D.-D. would discard it as a training test.

The following tests, which I found too hard, would appear to be properly placed: VII: describing actions, by B. and G. VIII: counting from 20 to 0, by B., Bo. and G. (considered a training test by D.-D.). IX: 6 memories by Bo. and G., but too hard by J. B. omits it on D.-D.'s objection (training). (Our IX-year-old epileptics average 4.8 memories; our X-year-olds, 5.3, and our XI-year-olds, 6.5).

In respect to the following tests the *discrepancies* are more patent than in any of the above tests: VI: three commissions, found to be properly placed by G., too easy by D.-D. and Bo., and too hard by B. and myself. VI: giving own age, distinctly too hard for epileptics, considered valueless by Bo., omitted by B., and considered a training test by D.-D. XI: uttering 60 words, too easy by D.-D., too hard by Bo., right for Age XII by J. and B., and for XI by G., and too hard for epileptics (about right for Age XII, where the average number of words was 59.9). XI: abstract definitions (justice, charity, kindness, used

at Skillman), right for Age XII by B. and Bo., too hard for XII by J., slightly too hard for XI by G., and distinctly too hard for XI for epileptics. XI: rearranging words, right for XII by B. and Bo., and for XI by G., too hard for XII by J., and distinctly too hard for epileptics of Age XI.

Having thus surveyed the available facts, we are now in a position to formulate a number of important conclusions.

(1) The marked irregularities in our curve of intelligence for epileptics are *partly explained* by the system of *advance scoring from a method of wide-range testing,* and by the method of *combining the records* of a large number of *adult* epileptics and a smaller number of *juvenile* epileptics (the proportion of the adults among the epileptics being larger than among the feeble-minded, as we have already seen). It might be assumed that the latter circumstance—to which we have merely adverted in the foregoing pages—would render the curve more or less irregular, for a defective child and a defective adult whose intellectual *strength or capacity* are the same, would not necessarily test out exactly the same by the B.-S. scale as at present constituted. We have, indeed, already noted here and there various differences between the children and the adults (others will be noted in the following chapter), and have found evidences of the loss of lower-age capacities among the adults. To measure the influence of this factor, however, it is necessary to examine the table of distribution (Table I), and particularly the table which shows the number of higher-grade sub-

jects who pass especially the crucial ages, Ages VI and IX (Table VI).

In the first table it is seen that, while there are about 3% more children than adults grading VI years, the number of IX-year-olds is approximately the same. The number of imbeciles among the children, however, is considerably higher than among the adults, while the number of morons and XIII-year-olds is noticeably less. In Table VI it is seen that of those testing from IX to XIII years, 22% of the children pass the IX-year tests, but only 5% of the adults (the differences for Ages X, XI, XII and XIII are also large, due possibly to the small number of patients in some of these ages), while of those testing from VI to X, none of the children passes Age VI, as against 11% of the adults (with large differences also for Ages VII to X).

While it is thus evident that an adventitious factor of this character—the averaging of the gradings of defective children and adults—will distort the symmetry of the frequency curve, an examination of the separate columns for children and adults in Table I shows that skews are present in the classifications of each, particularly at Ages IX and X, only less prominently for the children than for the adults. Hence, we appear to be justified in the conclusion that the distortions in our curve are not primarily caused by the method of advance scoring from wide-range testing or by the merging of the grades of young and old defectives.

(2) On the other hand, one of the significant causes of our skewed curve (skewed certainly as compared with the curve for feeble-mindedness) is the *intrinsic defectiveness of the measuring scale,*

for our analysis has demonstrated that there is a greater discrepancy in the B.-S. 1908 scale (and 1911 scale so far as Johnston's results indicate) than has hitherto been conceded or suspected. Its obvious inequalities affect not only some of the *individual tests* in various levels, but also the *age-standards.* Just how much of the irregularities can be ascribed to the defects in the scale it is impossible to determine with definiteness until a re-examination of epileptics has been made by a scale rendered maximally correct and standardized for "typical" American children.

(3) It is, however, not only probable, but reasonably certain, that the combined influences of the foregoing factors does not suffice fully to explain our curve. Three affirmative reasons may be given why another factor, namely, the peculiar mental make-up of the epileptic, must be considered. First, an inspection of Table VIII shows that the *percentage of failures on the difficult tests is abnormally large for the epileptics,* in nearly every case very much larger than for the normal groups, so that the corresponding traits in the epileptics have at least suffered *marked impairment.* Second, *some of the tests abnormally difficult for the epileptics do not always prove difficult for the normals.* Third, failures on some of the tests through various levels imply an *impairment of the same or related functions.* Thus, the epileptics suffer from a fundamental *impairment of memory,* as shown by consistent failures in all the tests of memory span (sentence and number tests), by the inability to reproduce six units from reading a short passage once, by the inability to recall their ages, and to remember and execute three simple com-

missions. They are also markedly retarded or feeble in the *higher thought processes,* the rational functions brought into play in the more intellectual tests and in the tests calling for an *adjustment to new situations.* This is shown by the incapacity to form a rectangle from two triangular pieces, to execute a triple order, to construct an intelligible sentence from displaced words, to give descriptive or classificatory definitions of common objects or abstract definitions of simple qualities, or to infer facts from given situations (the situations employed in the test, it may be conceded, do not well fit American conditions), or to utter 60 words in three minutes. The epileptics suffer from a pronounced *retardation of rate in the stream of thought and of motor response.* They apparently also suffer from a *blunting of the kinesthetic sensitivity:* the threshold of sensory discrimination for lifted weights is abnormally lowered. To carry the analysis further, however, is not advisable until the scale has been more accurately "calibrated." When this has been done, its value for individual mental diagnosis will be greatly enhanced.

While, therefore, the peculiarities in our curve can be partly ascribed to extraneous circumstances and to imperfections in the scale, they also implicate inherent anomalies in the mentation of the epileptic. In fact, our B.-S. testing has furnished us with a picture of the results of a process of mental wreckage caused by pathological processes going on in the afflicted individual or by a neuropathic heredity, whereby the integrity of various mental functions has been impaired at various levels of mental development, or whereby certain lower levels of mental

functioning have been swept away, while higher levels have remained intact—mental sentinels that have remained to tell the story of destruction. This interesting clinical picture of mental ruin and havoc is still incomplete in its finer delineations and invites further psycho-clinical research.

(4) Finally, the facts brought to view above should make it patent that the B.-S. scale is still in its *experimental stages*—a fact that should occasion no surprise when we consider the short time that it has been in use, particularly in this country. It still requires a thoroughgoing tryout and revision. Revisions have, indeed, already been attempted by Binet and Goddard. In some respects their changes harmonize with the requirements of our comparative table (Table VII), but in other respects not. In this table only the tests most obviously misplaced for epileptics have been compared with normal performances.) Since there is considerable disagreement in the conclusions of the five writers who have worked with normals in France, Belgium, Germany, England and the United States, it is obvious that the question cannot be considered closed. American investigators will have to establish norms for American children. The studies already made sufficiently indicate that a test too difficult for children of one nationality may be too easy for those of another. For American workers Goddard's results, based as they are upon an extensive testing of American children, are the most suggestive. But it appears to me wise to continue the use of the 1908 scale until more returns are in—until we have tested large masses of boys and girls by the *wide-range* testing to which I have already alluded. It is questionable whether we

can calibrate and improve the scale by confining the testing to a very limited range of years.

[Obviously, this work will require the earnest coöperation of many psycho-clinicists. More than that, it ought to receive the undivided time and attention of child study specialists—of a worker or group of workers who can devote themselves to this particular service as a life career. In my judgment, this work can probably not be done effectively and within a reasonable time unless it is established as an independent department of research. The clerical labor connected with investigations such as this is so onerous that it should be cared for by a force of clerical assistants. At the present time all, except possibly one, of the psycho-clinical investigators are swamped with purely clerical work (computing, tabulating, etc.), and must use up their best energies in purely routine and mechanical labor. This is uneconomical from the standpoint of public finance and the conservation of the nation's best creative brain power.]

The further improvement of the scale, we may add, requires the transposition of certain tests, the elimination of certain others which seem valueless, the equalization of the number in each age or the proper differential adjustment of the system of accrediting points, and the *increase rather than the decrease of the number of tests for each age.* I feel that the last point requires emphasis. We need to probe a considerable number of traits and capacities for the reason given (p. 42) if we would arrive at a true clinical picture of the child or a correct classification. We cannot hope to *diagnose* or *grade* accurately if we test only a few capacities, or if we base our judgments on only a few symptoms. The element of variation in human traits is too large. What is needed is a *well-balanced, comprehensive survey of the fundamental human mental capacities.* The minimal number of tests for each age should be placed, I believe, at ten. I should regard it as unfortunate to eliminate such tests as the *age, writing* and *reading tests.* All of these have furnished important information with respect to the epileptic (as well as

various types of insane patients recently tested). Nor is it essential to eliminate all the tests which are dependent upon *training* (or, indeed, all which are pedagogical), partly because this is not desirable and partly because this is impossible. Nature and nurture proceed hand in hand, inseparable, reciprocal, interacting and independent only in conception. Just as we posit a normal rate of development which the forces of human *nature* undergo—normal, that is, within limits—so we may posit a normal curve of development within variable limits for a given order of civilization or social evolution, which human changes follow as a result of the processes of *nurture*. We cannot, if we would, test merely *pure native* capacity uninfluenced by environmental agencies, except possibly during the first months of life. But we can measure native capacity as modified by the environment. In this country, where we have fairly uniform standards of educational requirements in the schools, there would seem little reason for eliminating some of the more fundamental academic tests. A child of eight or nine who cannot read at all certainly demonstrates his intellectual inferiority thereby.

To repeat: The evidence regarding the imperfections in the Binet-Simon measuring scale of intelligence cannot be brushed aside. The scale certainly has not yet been made maximally accurate or scientifically precise—scientifically precise in the Aristotelian sense (we may demand only that degree of accuracy in a given subject of inquiry which the subject-matter itself allows) or sufficiently standardized. A large work and a challenge remain for the students of *"Intelligenzprüfung"* — a work that will pay

double interest on a large investment of time and labor, for the public schools, juvenile courts and institutions for defectives stand in dire need of a simple, objective, practical mental measuring rod by which to determine the degree of mental arrest, defect or acceleration of deviating individuals, and by which properly to classify institutional cases.

In the light of the defects which we have found in the scale, what, then, shall we say of the value of the B.-S. system of classifying defectives? An answer to this question must await the analysis of the following chapter.

CHAPTER III.

THE VARIATION OF MENTAL AND PHYSICAL TRAITS IN RELATION TO THE AGE CLASSIFICATION OF THE BINET-SIMON SCALE.

Paidologists have been wont to accept the postulate that mental traits or capacities increase in efficiency or multiply in number with increasing age. The validity of the B.-S. scale itself depends on the validity of this assumption. If we accept the assumption as correct, the following conclusions follow:

First, it is feasible to construct a *graded scale* of mental performances consisting of a series of tests which either progressively increase in difficulty from year to year (similar tests being repeated at various levels) or measure new traits developing at various higher levels.

Second, it should be possible to arrange these tests in a fairly accurate *ascending age series,* so that we can locate the mental station of normal and abnormal individuals in units of mental age, and determine how any mental or physical characteristics vary in accordance with a fixed classificatory or graded scheme.

Third, by plotting *age-curves* for the *individual* traits tested in the scale (as well as for functions tested independently of the scale), we secure a means

of *trying out the accuracy* of the scale itself and of determining more fully to what extent these traits vary with age among normal and abnormal individuals.

In this chapter I shall be concerned with this third conclusion, because the imperfections revealed in the 1908 B.-S. scale by the data considered in Chapter II naturally raise the question whether or not the scale is of any practical value in the mental grading or diagnosis of normal or abnormal subjects. *If it can be shown that the* AVERAGE EFFICIENCY *in the various traits tested increases with growing age (annually or biennially), then the scale, in spite of its imperfections, and provided the mean variations in each age are not too large, remains a valuable means of determining, in comparable terms, the classification of* DIFFERENT HOMOGENEOUS *groups of persons.* For if the individuals were very poorly classified, we should expect to find obvious irregularities or skews in the curve of efficiencies for each trait, and extreme mean variations. Of course, the relevancy of the scale, even if it be imperfect, for determining the *relative* station of different individuals in the *same* homogeneous group, needs no argument.

The discussion of the scale will also serve to bring to view various facts of considerable interest respecting the mental efficiencies of epileptics.

In order satisfactorily to analyze our data it will be necessary to examine the averages for the entire population, of all ages and both sexes, in the various tables, and the corresponding mean variations. The former will be examined with considerable thoroughness, the latter more briefly. Finally,

a concluding section will be devoted to the more general conclusions and comparisons.

It is unfortunate that, in the absence of the original data, it will be necessary to limit this study to four B.-S. tests, and to tests with the form-board, dynamometer and ataxiagraph.

Explanation of Tests.

In the color test (Table X) the patients (224 epileptics between the B.-S. ages III and XIII) were uniformly, with few exceptions, instructed to name the four colors as rapidly as possible. The experimenter pointed to each color in succession rapidly, so that the results would represent maximal performances were it not for the fact that the green used in the testing of about one-half of the patients was poorly saturated, and therefore caused hesitation or failures. Green, even at its best, is the least frequently named of these colors, among normal persons, as appears in Bobertag's B.-S. testing of German children, while red is the most frequently named. Blue and yellow were about equally difficult. The following was found by Winch to be the order of the correct application of color names among children three to five years of age: black, white, red, blue, green, yellow, violet and orange. The order agrees with Bobertag's, except that green is placed ahead of yellow. In my testing of epileptics no other single color caused so many delays, indecisions or failures as green. I agree fully with Bobertag that these colors, in order to serve a useful purpose in the scale, should be standardized.

In the test of uttering discrete words the subjects were always told to utter just as many single words

as possible during three minutes or until told to stop (Table XV). Those who were slow were usually incited to greater effort by verbal suggestions. Three or four examples, illustrative of the object of the test, were furnished at the outset. No record was included which consisted merely of phrases or sentences or which consisted of any considerable number of these, and none was excluded because of peculiarities in the word lists (such as uttering many numbers—unless, indeed, all the words were numbers—or letters of the alphabet, or names of months or days).

In the reading test (Tables XI and XVII) the following selection was used:

Three | houses | on | fire.
New York, | September 5th. | A fire | last night | destroyed | (three houses) in the center of the city. |
Seventeen | families | are without homes. | The loss is more than | thirty thousand dollars. |
In saving | a child | who was asleep in bed, | one of the firemen | was badly | burned | on the hands and arms. |
(The units are indicated by the line divisions. In a few cases half credits were given; *e. g.*, half a memory for "September," "on the hands," "thirty thousand.")

The subjects were merely told to read the selection, without intimation that they would be expected to reproduce it. To many this test was given after some of the speed tests, so that a number of subjects undoubtedly inferred that they were expected to read the passage as rapidly as possible. The results may therefore be a trifle better than the general average.

In the form-board (Table XIII) and hand dynamometer (Table XIX) tests the patients were, again, invariably urged to do their best, and only their best records are averaged in the tables. Each one was given three trials each with the Vineland pattern

form-board and the Smedley dynamometer, but the tests were repeated during second or third sittings for many subjects, so that frequently the figures utilized are the best single records in from six to nine trials. It may be said, parenthetically, that the best form-board record was by no means always the last one; on the contrary, *many epileptics lost with practice or familiarity.*

Uniformly, the form-board was placed directly in front of the subject, with the side containing the star nearest. The subjects saw the blocks removed from their proper places by the experimenter. The blocks were thrown into a heap on the table along the farther side of the board, instead of along either end, so that they should be equally distant from the two hands. Either hand could thus be used with the same ease. The subjects were told to use only one hand.

The same uniformity of procedure was used in the dynamometer test. The instrument, properly adjusted to the size of the hands, was placed by the experimenter, dial up, in the subjects' hands so that the palms always faced up. Two results thereby follow: (1) the subjects were able to see the movement of the registration pointer; and (2) the thumb sides of the two hands, which probably exert a greater pressure than the little finger sides, came into contact with the opposite ends of the stirrup of the dynamometer. This circumstance may be of some importance in dynamometry work, as indicated by a series of calibration tests of the instrument, which showed that the same weight on the two sides of the stirrup does not give exactly the same reading.

The weights were suspended from the stirrup by an iron hook, so made as to move freely (without friction against any stationary part)

when the dynamometer was lifted from the dial end. Thus pressure was exerted on the stirrup in much the same way as when it is squeezed by the hand. The hook was suspended from one of three points on the stirrup: the middle and either end. "Normal" indicates that the weights were lifted slowly or with moderate rapidity; "fast," rapidly or with a quick jerk. (The weights were weighed on a new pair of platform scales, so that the weighing is probably correct.)

TABLE IX.

Calibration Tests of the Smedley Dynamometer.

Objective Weight	Result of Normal Lift.			Result of Fast Lift.		
Kg.	Right.	Middle.	Left.	Right.	Middle.	Left.
5.2	4.7	5.2	4.7			
12.4	10.3	11.7	10.0	16.	19.	
16.5	14.1	16.4	14.3	15.	24.7	16.1
31.7	28.2	30.6	27.4		36.	
48.2	45.	45.7	35.5			
60.3	48.8	58.2			64.9	

The figures are averages of from three to twenty trials.

A number of interesting facts appear from a study of these figures. (1) Pulls on the right and left side of the stirrup practically always gave a different reading, usually amounting on the average to a fraction of a kilo (but with a maximum of nearly 10 kg.). In most instances the right side of the stirrup gave the larger registration. (2) The middle pull in all cases gave the highest registration—presumably because the pulls at the ends occasion friction along the sides of the piston. The difference between the middle and side pulls ranges between 1.4 and 3.2 kg. (two extremes excepted)—a difference so large as seriously to threaten to vitiate dynamometry work. *Consequently it is of the utmost importance in testing with the Smedley dynamometer that the subjects exert the pressure along the* MIDDLE *of the stirrup.* This precaution is by no means always observed, particularly not when readings are taken while the handle has been allowed to slide out of the palm on the side opposite the thumb. In this case the pressure is exerted at the end of the stirrup, with a consequent loss. In the present research the attempt was made to secure middle pressure. This instrumental defect should be remedied. (3) If we consider the middle registrations, it appears that the dynamometer in use was not true to scale, except for one or two weights. The spring was slighty too stiff. The inaccuracy, moreover, seems to increase with increasing pressure, as shown by these differences for the successive weights (beginning with 12.4 kg.): .7, .1, 1.1, 2.5 and 2.1 kg. In the interest of scientific precision, dynamometers must be calibrated as accurately as possible and tested objectively from time to time. (4) The testing with the same weights sometimes differed quite considerably on different days (the tests were made between December and March). This may possibly be due to temperature or other atmospheric changes which may alter the tension of the spring. Is this a remediable defect? (5) The differences between the

"normal" and fast or jerky lifts were large, amounting, for the "middle" readings, to 7.3, 8.3, 5.4 and 6.7 kg. for the different standards. (The friction of the recording pointer was kept uniform during all the tests.) The quick lifts or jerks, of course, invariably gave higher readings. It is therefore evident that *dynamometry results may be invalidated, for purposes of comparison, by differences in the method of squeezing.* I have found that most subjects tend to apply a steady, gradual pressure. But there are many who give a rapid or violent squeeze. Nearly all of our tabulated results were obtained by the first method. The readings, however, according to the above figures, appear to be somewhat too low. It should be added that no results are tabulated from subjects having any but slight injuries in one or both hands or arms.

Finally, in the ataxiagraphic test (Table XXII) the subjects were required to stand under a small horizontal sliding board, to which was fastened a tracing record-sheet of white paper. The board could be moved vertically, so that it could be adjusted to any height of subject, and also sagittally, so that the ataxiagram could be properly placed on the paper with reference to the antero-posterior axis. The ataxiagram was made by a soft marking pencil, which was glued to a band of spring metal, attached to a sort of ataxiagraphic helmet, which consisted of two curved encased metal bands fitting snugly over the cranium. The spring kept the tracing pencil in constant contact with the paper, except when the subject dropped the head or swayed too much. In such cases the experimenter was sometimes able to lower the tracing sheet, or if not, to trace the record by hand with sufficient accuracy. In a number of cases in which the ataxiagram extended beyond the paper it was possible for the experimenter to determine the extent of the departure. At the beginning the spring was depressed by the experimenter's hand until the record board had been properly adjusted. The starting point on the ataxiagram, the point of initial contact, or a point not far removed from this point,

would have afforded four measurements, anterior, posterior, to right, to left; but the data for this tabulation are not now available, so that in Table XXII only the gross measurements are given for the antero-posterior and lateral sways, irrespective of the point of initial contact.

Two methods were employed in this test. In the first, the subjects were instructed to stand with the feet placed to form a V (heels together). In one series the eyes were closed, and in the other the open eyes were allowed to rove at will. In the second method they were instructed to stand with both heels and toes close together, with hands hanging along the sides, and the eyes, when open, fixated on a black disc (about 1 inch in diameter) attached to the window curtain about 12 feet away. The disc was adjusted to a level with the subject's eyes. In neither method were the subjects instructed to try to stand still or rigidly, but simply to stand naturally. Nothing was said regarding the object of the test. With both methods about half the subjects were first tested with the eyes closed and about half with the eyes open, and each test (given in close succession) lasted exactly one minute. Table XXII contains the data secured by the second method only. A search of the available literature indicated that there has been no uniformly observed method in this test, but the second method here described seems to the author to possess most merits. The limiting of the tabulation to the second method explains, in part, why no more records are used in the study (104 males and 40 females): the station of many patients was taken by the first method. Another reason is that ataxiagrams secured from ataxic, choreic, paralytic, para-

plegic or hemiplegic subjects were excluded from the tabulation. Accordingly, the ataxiagrams used should represent the body sway in epilepsy uncomplicated by special permanent motor disturbances. It should be added that a number of patients, particularly low-grade ones, either did not fixate the disc at all, or allowed the eyes to rove more or less.

Analysis of the Averages.

In Tables X, XI and XIII an increase of efficiency or capacity with increasing B-S. age is shown by a *progressive diminution* of the *time* of execution. In the corresponding graphs (II, IV and VI) this is shown by a *drop* in the curves.

The Time Needed to Name the Four Colors—Red, Yellow, Green and Blue.

The time required to name the four colors, Table X, does, indeed, decrease with increasing B.-S. age, but the decrease from year to year is not very regular, as seen at a glance in Graph II. There are numerous exceptions in the averages for the general population, the children and the adults. The exceptions are least numerous among the girls and women. The differences, however, between the groups, the imbeciles and morons, for all patients, 4 seconds, and especially between Age III and Age XIII, about 7 seconds, are quite considerable. The difference between the averages of Ages VI and VII and of the moron group is much greater for the adults than for the children (3.7 sec. compared with 1.1); for the girls than for the boys (.9 as against .2), and for the men than for the women (6.8 as against 3.1). The sex differences are also brought out by the general

TABLE X.

Seconds Required to Name Four Colors (Red, Orange, Green and Blue).

B.S Age.	Boys			Girls			Children			Men			Women			Adults			Males			Females			Entire Population.		
	No.	Sec.	M.V.	No.	Sec.	M.V.	No.	Sec.	M.V.	No.	Sec.	M.V.	No.	Sec.	M.V.	No.	Sec.	M.V.	No.	Sec.	M.V.	No.	Sec.	M.V.	No.	Sec.	M.V
III										1	15.0		1	6.0		2	10.5					1			2	10.5	
IV	1	25.0		1	3.6		2	14.3		1	6.0					1			2	15.5		1			3	11.5	
V	1	8.8		1	6.0		2	7.4		1	15.0					1			2	11.9		1			3	9.9	
VI	1	6.0		3	6.0	2.8	4	6.0	2.8	2	19.9	15.1	4	8.9	3.0	6	12.6	9.0	3	15.2		7	7.6	2.9	10	9.9	
VII	3	6.2	2.5	5	8.2	2.2	8	6.6	2.3	6	7.2	2.1	9	5.6	2.0	15	6.3	2.0	9	6.5	2.3	14	6.6	2.1	23	6.7	2.2
Ave.		6.1[3]			7.1[3]	2.5[3]		6.3[3]	2.5[3]		13.5[3]	8.6[3]		7.2[3]	2.5[3]		9.4[3]	5.5[3]		10.8[3]			7.1[3]	2.5[3]		9.7	
VIII	7	9.1	2.7	6	5.7	1.6	13	7.5	2.1	16	8.2	3.8	20	5.	2.0	36	6.5	2.9	23	8.5	3.2	26	5.2	1.8	49	6.7	2.5
IX	6	4.4	.6	3	4.1	1.9	9	4.3	1.2	9	7.2	3.0	7	3.3	1.1	16	5.4	2.0	15	6.0	1.8	10	3.5	1.5	25	5.0	1.6
X	14	4.8	2.6	7	4.0	1.4	21	4.5	2.0	20	6.7	3.3	27	5.0	2.5	47	5.7	2.9	34	5.9	2.9	34	4.8	1.9	68	5.3	2.4
XI	4	5.7	1.5	1	1.6		5	4.8		13	5.8	2.7	4	3.1	1.0	17	5.1	1.8	17	5.7	2.1	5	2.8		22	5.1	
XII	2	7.8	.8				2			5	5.8	5.0				5			7	6.4	2.9				7	6.4	
Mor.		6.3	1.8		3.8	1.6		5.2	1.7		6.7	3.5		4.1	1.6		5.7	2.4		6.5	2.6		4.1	1.7		5.7	2.1
XIII	2	1.8	.2				2			6	3.1	1.6	4	5.3	2.0	10	4.0	1.8	8	2.8	.9	4			12	3.6	
Ave.		5.7[1]	1.5		4.9[1]	1.9		5.7[1]	2.1		7.9[1]	4.5		5.2[1]	1.9		6.5[1]	3.2		7.1[3]	2.3		5.1[1]	2.0		7.3[3]	2.1

No., number of patients included in averages. Sec., seconds (averages). M. V., mean variation (The M. V.'s given for the children represent the averages of the M. V.'s for the boys and girls; and similarly for the other general averages, instead of the averages of the boys' and girls' counts combined into one series). Mor., morons. B.-S., Binet-Simon.

The averages include all who named the colors *correctly*, whether or not this was done within the time limits (6 seconds). Seventy exceeded the time limits: 14 boys, 9 girls, 28 men and 19 women. Six extreme records were, however, excluded from the table. Many were unable to name all four colors.

[1]Averages for all ages above and including Age VI. [2]Average for Ages III to XIII, inclusive. [3]Averages for Ages VI and VII.

All under 21 are tabulated in all tables as "boys," "girls" and "children"; all from 21 up, as "men," "women" and "adults." "Males" include all juvenile and adult males; "females," all juvenile and adult females.

averages for Ages VI to XIII, from which it appears that the girls are superior to the boys (average of 4.9 sec. compared with 5.7); the women to the men (5.2 compared with 7.9); and the children to the adults (5.7 compared with 6.5). In such a simple trait as the time of naming four colors it may be assumed in harmony with the above findings that increasing maturity will not accelerate the speed after the colors have once been really learned.

The following *conclusions* seem to be justified:

(1) Significant sex and maturity differences (differences between the juvenile and adult *periods* of life) are brought out in so simple a test as the speed of naming the four fundamental colors. Epileptic children are superior to adults, and girls and women to boys and men. That normal girls excel normal boys in the knowledge of colors has been shown before. Bobertag recently found this condition to obtain in this very test. Moreover, it is stated that color-blindness is more prevalent among males than females (in about the proportion of 4% to .5%). There is a bigger difference between high and low grade adults than between high and low grade children.

(2) This trait (the speed of naming the colors) apparently reaches its maturity at about Age IX.

(3) In this test the increase with each increasing B.-S. age is not very regular, indicating either that the subjects are not very closely classified or that this is not a very satisfactory test by which to check the accuracy of the scale.

TABLE XI.

Seconds Required to Read the Selection About a Fire.

B.-S. Age.	Boys				Girls				Children			Men				Women				Adults			Entire Population.		
	No.	Ave.	M.	M.V.	No.	Ave.	M.	M.V.	Ave.	M.	M.V.	No.	Ave.	M.	M.V.	No.	Ave.	M.	M.V.	Ave.	M.	M.V.	Ave.	M.	M.V.
VI.	1	215.0										2	35.0		5.0	3	65.3	68.0	8.8	53.2		6.9	80.1		(6.9)
VII.	2	168.5		3.5	2	149.0		16.0	158.7		9.7	2	117.5		2.5	4	105.5	106.0	24.0	109.5		13.2	129.2		11.4
Ave.[1]		191.7											76.2		3.7		85.4	87.0	16.4	81.3		10.0	104.6		
VIII.	7	156.2	155.0	30.9	4	125.0	123.0	49.2	145.1	139.0	40.0	14	88.3	84.5	46.0	17	47.0	42.0	16.5	65.7	63.2	31.2	86.5	101.1	35.6
IX.	6	106.6	83.0	57.2	3	44.0	40.0	15.3	85.7	61.5	36.2	10	57.2	37.0	35.0	11	46.6	41.0	17.6	51.7	39.0	26.3	61.9	50.2	31.2
X.	16	73.5	31.0	58.2	6	47.0	39.5	13.6	66.3	35.2	35.9	26	40.4	26.0	21.2	28	32.0	22.0	15.4	36.1	24.0	18.3	44.6	29.6	27.1
XI.	6	37.8	35.5	11.8	3	18.6	19.0	11.3	31.4	27.2	11.5	14	26.7	23.0	8.7	5	17.4	17.0	1.2	24.2	20.0	4.9	26.5	21.5	8.2
XII.	2	26.0		6.0								5	18.0	17.0	3.2	3	30.0	20.0	16.6	22.5	18.5	9.9	23.2	17.7	9.9
Mor.		80.	76.1	32.8		58.6	55.4	22.3	82.1	65.7	30.9		46.1	37.5	22.8		34.6	28.4	15.8	40.0	32.9	18.1	48.5	44.0	22.4
XIII.	2	18.5		2.5								9	19.0	17.0	4.8	7	17.8	17.0	2.6	18.5	17.0	3.7	18.5	17.0	3.3
Ave.		83.8[2]		24.3		78.7		21.1	97.4		26.6		50.2		15.8		45.2	41.6	12.8	47.6		14.3	58.8		16.7

No., number of patients included in the averages (Ave.). Ave.,[1] averages for Ages VI and VII. M., median. M. V., mean variation (average deviation), calculated from the averages.

[2]Exclusive of Age VI. All who were tested between Ages I and V, inclusive, failed, except three in Age V (Ave.=103.6 sec.)

The Time Required to Read the Passage About a Fire.

On the other hand, the time required to read the selection, Table XI, decreased appreciably and regularly (as is strikingly apparent in Graph IV), with only one exception among the girls, and two each among the men and women. The reading time ranges from 129.2 sec., Age VII, to 18.5 sec., Age XIII, a difference of 80.7 sec. The difference between the averages of Ages VI and VII and of the moron group amounts to as much as 56.1 sec. for the general population, 111.7 for the boys, 50.8 for the women, and 30.1 for the men. The shortening of the time from each age from IX to XIII amounts, respectively, to 24.6, 17.3, 18.1, 3.3. and 4.7 sec.—a series of progressive improvements. The largest and most consistent improvements in these years are made by the boys and men (ignoring the girls and children, where the data are incomplete), as seen in Table XII.

TABLE XII.

Improvement in Reading Capacity with each B.-S. Age. (The figures represent the gain in seconds made by a given age over the next preceding age, based on Table XI.)

Age.	Boys.	Girls.	Children.	Men.	Women.	Adults.
IX	49.6	81.0	77.5	31.1	.4	14.0
X	33.1	— 3.0	26.3	16.8	4.6	15.6
XI	35.7	28.4	8.0	13.7	14.6	11.9
XII	11.8			8.7	—12.6	1.7
XIII	7.5			— 1.0	12.	4.0
Ave.	27.5	35.5	37.2	13.8	3.8	9.4

A minus sign indicates loss of efficiency.

From Table XI it is apparent that, in respect to reading ability as gauged by time, the girls are dis-

tinctly superior to the boys (shorter time in all ages and in the averages); the adults to the children (in all ages and the averages), and the women to the men (in six of eight ages and in two averages).

We may accordingly *conclude* that the reading test is a valuable test for four reasons:

(1) It discloses significant sex and maturity differences. Here the epileptic females surpass the males and the adults the children. But the difference between the high and the low grade groups is greatest for the boys.

(2) The considerable superiority of the adults indicates that reading is an adult art, and that it seems to be worth while to teach reading to epileptics in spite of their tendency toward progressive deterioration or degeneration. This point, however, requires special investigation.

(3) Apparently there is a large age-difference in reading capacity, particularly from VII or VIII to XI. The very considerable gain at IX seems to indicate that there is a pronounced advance in reading ability for epileptics at this age. At the same time it is seen that the progressive decrease in the reading time is fairly regular from VIII to XI.

(4) A reading test thus supplies a valid test for differentiating mental capacity and for checking the accuracy of intellectual measuring scales—albeit the test is more pedagogical than psychological. As judged by the time of reading, the B.-S. grouping appears to be fairly satisfactory.

It seems, therefore, unwise to eliminate the test

from the scale, as Binet has done in the latest (1911) revision. So important was the reading test in the original B.-S. scale that it was used as the differential between two groups of defectives, the imbeciles and the morons—the latter of whom can be taught to read, while the former cannot. The fact that the test is more pedagogical than psychological, and that it represents the results of training, should not necessarily militate against its use for psychological diagnosis. The attempt to teach children to read will probably have been made in the case of the majority of subjects who will ever be tested.

The Time Required to Replace the Blocks in the Form-Board.

In this test (Table XIII) there are decided and consistent gains (as is markedly apparent for the general population in Graph VI), with three exceptions each among the boys and girls, and two each among the men and women. The difference between Ages I and XIII amounts to 211.6 sec., and between the imbecile and moron groups 84.4 sec. The difference between the imbeciles and morons is consistently larger for the girls than for the boys (97.7 as against 78.7 sec.); for the men than for the women (63.6 against 50.9), and for the children than for the adults (89.1 as against 63). On the other hand, the male morons are five times as efficient as the male imbeciles; the female morons three times as efficient as the female imbeciles; the boy morons 5.5 times as efficient as the boy imbeciles, and the girl morons 5.2 times as efficient as the girl imbeciles. The corre-

TABLE XIII.

Seconds Required to Replace Blocks in the Form-Board.

B.-S.	Children (under 21)						Children			Men			Women			Adults			Males			Females			Entire Population.		
	Boys			Girls																							
Age.	No.	Ave.	M.V.	No.	Ave.	M.V.	No.	Ave.	M.V.	No.	Ave.	M.V.	No.	Ave.	M.V	No.	Ave.	M.V.	No.	Ave.	M.V.	No.	Ave.	M.V.	No.	Ave.	M.V.
I													1	226.0											1	226.0	
II				1	97.0					2	69.0	2.0	3	90.0	20.6		81.8					4	91.7		6	84.1	
Id.														158.0												155.0	
III	2	201.0		3	406.0	200.0	5	325.0		3	65.3	22.4	0						5	119.6					8	227.0	111.2
IV	3	86.3	31.1	3	68.0	20.6	6	77.1	25.8	2	95.5	45.5	4	168.5	84.2	6	144.1	64.9	5	90.0	38.3	7	125.4	52.4	12	110.6	45.3
V	1	52.0		1	46.0		2	49.0		3	160.0	112.6	3	31.3	3.5	6	95.6	58.0	4	133.0		4	35.0		8	84.0	58.0
VI	4	114.2	54.2	6	39.6	16.2	10	69.5	35.2	7	67.1	26.1	5	47.2	18.7	12	58.8	22.4	11	82.2	40.1	11	43.0	17.4	22	63.6	28.8
VII	5	26.4	5.7	6	43.6	23.0	11	35.8	14.3	9	29.6	8.6	12	31.7	9.4	21	30.8	9.0	14	28.5	7.1	18	35.7	16.2	32	32.5	11.6
Im.		95.9	30.3		120.6	64.9		108.3	47.6		83.5	43.0		69.6	28.9		82.3	35.9		90.6	42.2		59.7	28.7		103.5	50.9
VIII	9	20.5	4.8	6	39.8	11.2	15	28.2	8.0	19	27.1	5.7	20	22.1	5.8	39	24.5	5.7	28	25.0	5.2	26	26.2	8.5	54	25.5	6.4
IX	6	19.3	2.0	3	23.3	6.4	9	20.6	4.2	10	22.7	4.9	9	19.2	2.6	19	21.0	3.7	16	21.4	3.5	12	20.2	4.5	28	20.9	4.0
X	16	16.0	1.9	8	17.7	2.2	24	16.6	2.0	27	20.0	4.5	31	19.9	4.9	58	19.9	4.7	43	18.5	3.2	39	19.4	3.5	82	18.9	3.4
XI	6	16.3	2.6	2	14.0	0.0	8	15.7	1.3	14	15.9	1.8	5	17.4	1.9	19	16.3	1.8	20	16.0	2.2	7	16.4	.9	27	16.1	1.6
XII	2	14.0		1	17.0		3	15.0		5	14.2	1.4	3	16.3	0.9	8	15.0	1.1	7	14.1	1.4	4	14.5	.9	11	15.0	1.1
Mor.		17.2	2.8		22.9	4.9		19.2	3.8		19.9	3.6		18.9	3.2		19.3	3.4		19.0	3.1		19.3			19.1	3.3
XIII	2	16.0								9	13.7	1.6	7	14.8	1.8	16	14.2		11	14.1	1.6			1.8	18	14.4	1.7
Ave.		52.9	14.6		73.8	34.9		65.2	12.9		50.0	19.7		58.7	14.0		47.4	17.1		51.1	11.4		42.7	11.8		72.2	24.8

No., number of patients included in the average (Ave.). M. V., the mean of the deviations of the various counts from the average, calculated as before. The average are based on the best records in three trials (infrequently only two trials). Three extreme records were excluded from the averages.

Id., idiots. Im., imbeciles. Mor., morons.

In Age I five failed entirely, while only one succeeded; in Age II seven failed and two succeeded; in Age III one failed and seven succeeded; in Age IV two failed and twelve succeeded; in Age V two failed and eight succeeded; none failed above V, though some succeeded with great difficulty. The slowest successful performance recorded required 692 sec. (Age III, girl), and the next 420 sec. (Age III); and the fastest, 11 sec. (by 5 in Ages X, XI, XII and XIII).

sponding figure for the children is 5.6, for the adults 4.2, and for the entire population 5.4.

A further study of the sex-differences shows that there is no constant difference between the male and female imbeciles, each being superior in two ages. Among the morons the males are superior in all except Ages IX and XI. But, in the general average, the females excel by 8.4 sec.

Among the men and women the same lack of constancy occurs, each being superior in about half of the ages, but the men excel by 8.7 sec. in the general average.

Again, the girl imbeciles surpass the boy imbeciles in three of the five ages. But the boys excel in the general average by 24.7 sec., and the boy morons are distinctly superior to the girl morons, excelling in all ages but Age XI, with a general moron average that is higher by 20.9 sec.

Finally, the same lack of constancy obtains between the children and adult groups, the former being superior in five ages and the latter in four. But the general average for the adults is distinctly better (by 17.8 sec.).

The gains from year to year, beginning with Age V, amount to 26.6, 20.4, 31.1, 7.0, 4.6, 2.0, 2.8, 1.1 and .6 sec.—a progressively diminishing series of improvements. A comparison of the improvements in the separate columns shows that the gains, as well as the fluctuations (losses), are considerable in Ages V, VI and VII, and that, from VII or VIII on, the capacity functioning in this test becomes more stable: the gains are smaller, and the losses are smaller and less frequent. This appears from an examination of Table XIV.

TABLE XIV.

Gains or Losses made in the Time Required to Replace the Blocks in the Form-Board. (The figures indicate the difference in seconds between a given age and the next previous age, based on Table XIII.)

B.-S. Age.	Boys.	Girls.	Children.	Men.	Women.	Adults.	Males.	Females.
V	34.3	22.0	28.1	—64.5	137.2	48.5	—43.0	90.4
VI	—62.2	6.4	—20.5	92.9	—15.9	36.8	50.8	—8.0
VII	87.8	—4.0	33.7	37.5	15.5	28.0	53.7	7.3
VIII	5.9	3.8	7.6	2.5	9.6	6.3	3.5	13.5
IX	1.2	16.5	7.6	4.4	2.9	3.5	3.6	6.0
X	3.3	5.6	4.0	2.7	— .7	1.1	2.9	.8
XI	— .3	3.7	.9	4.1	2.5	3.6	2.5	3.0
XII	2.3	—3.0	.7	1.7	1.1	1.3	1.9	1.9
XIII	— 2.0			.5	1.5	.8	.0	
Ave.	7.8	6.4	7.7	9.1	17.0	14.4	8.3	14.2

The boys show a greater average improvement in these ages than the girls, the adults than the children, the women than the men, and the females than the males. Much of the superiority of the adults and females, however, is due to the abnormal gain in Age V. The small gains between XII and XIII are due either to the relative maturity of the capacity at XII, to the fewness of the subjects or to the failure of the B.-S. scale sufficiently to differentiate capacity for these ages.

From the above survey we *conclude:*

(1) That there may be certain sex-differences, and differences as between adults and children, in the capacity functioning in this test, but these differences do not appear very clearly with epileptics. Here the males appear to surpass the females, particularly among the high-grade subjects. The boy morons are distinctly superior to any other group, and the adults excel the children both in the general average and in the amount of improvement from year to year.

(2) The capacity improves quite regularly, in progressively diminishing amounts, with each increasing B.-S. age. The irregularities in the lower ages are probably due to the fewness of the subjects.

(3) Accordingly, this is a fairly good test for purposes of classification, diagnosis and testing the accuracy of intelligence scales, at least between the Ages of VI and XII.

(4) Judged by the time required to replace the blocks, the B.-S. classification of the patients possesses a very fair degree of reliability.

If we now turn to the tables (XV, XVII and XIX) in which increasing capacity is shown by increments in the *output* within fixed time-limits, we find again evidences of improvement with each growing B.-S. age. This improvement is indicated by rising curves in the graphs (III, V and VII).

Number of Words Uttered in Three Minutes.

The number of words uttered increases regularly (Table XV), with one exception each among the men, women, girls and boys, from 16 words at Age VI to 65 at Age XIII, a difference of 49 words. There is only one skew in the graph (III). The difference between the average of Ages VI and VII and the moron group amounts to 21.2 words for the general population, 25.9 for the boys, 23.2 for the girls, 24.2 for the men, 17.5 for the women, 23.4 for the children, 20.9 for the adults, 36.2 for the males, and 18.2 for the females. The difference between the high and low grade patients is thus greatest for the males (both boys and men) and the children. The differences between each of the successive ages from IX to XIII amount to the following for the entire popu-

TABLE XV.

Test of Free Association: Average Number of Single Words Uttered in Three Minutes.

B.-S. Age.	Children (under 21)								Adults (over 21)															
	Boys			Girls			Child'n		Men			Women			Adults		Males			Females			Entire Pop.		
	No.	W.	M.V.	No.	W.	M.V.	W.	M.V.	No.	W.	M.V	No.	W.	M.V.	W.	M.V.	No.	W.	M.V.	No.	W.	M.V.	No.	W.	M.V.
VI	1	8.0		1	30.0		19.0		1	10.0		1	16.0		13.0		2	9.0		2	23.0		4	16.0	
VII	3	28.6	3.4	4	23.2	15.3	25.5	9.3	3	25.6	10.3	4	25.7	10.2	25.6	10.2	6	27.1	6.8	8	24.4	12.7	14	25.5	9.7
Ave.		18.3			26.6		22.2			17.8			20.8		19.3			18.0			23.7			20.7	
VIII	7	29.4	13.2	5	15.4	6.0	23.6	9.6	14	20.6	7.5	12	20.4	8.0	20.5	7.7	21	23.5	10.3	17	18.9	7.0	38	21.5	8.6
IX	6	32.1	11.1	3	32.6	13.8	32.3	12.4	5	36.0	11.6	7	33.1	4.0	34.3	7.8	11	34.3	11.3	10	33.0	8.9	21	33.4	10.1
X	16	42.8	9.2	8	51.1	12.3	45.5	10.7	17	47.1	13.0	24	39.0	12.2	42.4	12.6	33	45.2	11.1	32	42.0	12.2	65	43.6	11.6
XI	6	52.0	10.3	2	67.0	14.0	55.7	12.1	12	49.5	14.0	4	48.0	12.5	49.1	13.2	18	50.3	12.1	6	54.3	13.2	24	51.3	12.6
XII	2	65.0	4.0	1	83.0		71.0		5	56.8	15.3	2	51.0	4.0	55.1	9.6	7	67.7	9.6	3	61.6	6.8	10	59.9	8.2
Mor.		44.2	9.5		49.8	11.5	45.6			42.0	12.2		38.3	8.1	40.2	10.1		44.2			41.9			41.9	10.2
XIII	2	69.5	1.5						9	65.6	19.5	6	62.6	8.0	64.4	13.7	11	63.3	10.5	6	62.6		17	65.0	9.6
Ave.		40.9	7.5		43.1	12.2	38.9	10.8		38.9	13.0		36.9	8.4	38.0	10.7		40.0	10.2		39.9		193	39.5	10.

No., number of patients included in averages.
W., number of words uttered (averages, except where the result for one patient only is recorded). Mor., morons.
M. V., mean variation or average deviation. (The M. V.'s in the columns for the children, adults, males, females and entire population are averages of the averages for each series for the boys, girls, men and women considered separately).

lation: 11.9, 10.2, 7.7, 8.6 and 5.1. The corresponding figures for the separate groups are shown in Table XVI.

TABLE XVI.

Gains or Losses with each B.-S. Age in the Number of Words uttered in Three Minutes. (The figures indicate the difference in the number of words given in a given age and the next previous age, as computed from Table XV.)

Age.	Boys.	Girls.	Children.	Men.	Women.	Males.	Females.	Adults.
IX	2.7	17.2	8.7	15.4	12.7	10.8	14.1	13.8
X	10.7	18.5	13.2	11.1	5.9	10.9	9.0	8.1
XI	9.2	5.9	10.2	2.4	9.0	5.1	12.3	6.7
XII	13.0	6.0	15.3	7.3	3.0	17.4	7.3	6.0
XIII	4.5			8.8	11.6	—4.4	1.0	9.3
Ave.	8.0	11.9	11.8	9.	8.4	7.9	8.9	8.7

Here the gains are the highest for the girls and children. They continue, though in diminished degree, to Age XIII. This indicates, as one might expect in a test of this sort, that the rate of utterance increases beyond the age of XIII, so that a free association test might be found valuable at higher levels. (Possibly a controlled association test would be still more valuable at various levels.) In the rate of word utterance the girls excel the boys (better in five of the ages and in the three averages); the men the women (better in seven ages and in two averages); the children the adults (better in five of eight ages and in three averages), and the males the females (in six of eight ages and in two averages).

The following *conclusions* follow:

(1) There are certain sex and maturity differences in the free association test, although the sex-differences do not appear very clearly among these epileptics. (We are speaking of quantitative, not qualitative differences.) The girls seem to surpass the boys, the men the women, and the children the

TABLE XVII.

Number of Units (Memories) Reproduced in Reading Test of Ages VIII and IX.

B.-S. Age.	Boys			Girls			Children		Men			Women			Adults		Males			Females			Entire Population.		
	No.	Ave.	M.V.	No.	Ave.	M.V.	Ave.	M.V.	No.	Ave.	M.V.	No.	Ave.	M.V.	Ave.	M.V.	No.	Ave.	M.V.	No.	Ave.	M.V.	No.	Ave.	M.V.
VII	2	1.5	.5	4	2.3	0.9	2:0	.7	2	1.5	0.2	5	2.4	0.8	2.1	.5	4	1.5	0.3	9	2.3	.7	13	2.1	.5
VIII	7	3.9	1.0	4	2.7	0.7	3.5	.8	16	3.4	1.1	15	3.5	1.3	3.5	1.2	23	3.5	1.0	19	3.3	1.0	42	3.7	1.0
IX	6	4.7	1.6	3	4.6	1.8	4.7	1.7	10	5.3	0.9	8	4.5	1.2	4.9	1.0	16	5.0	1.2	11	4.5	1.5	27	4.8	1.3
X	16	8.0	2.0	8	4.3	1.8	6.8	1.9	25	4.3	1.6	31	4.8	1.5	4.6	1.5	31	5.8	1.8	39	4.6	1.6	70	5.3	1.7
XI	6	6.6	1.3	2	4.7	0.2	6.1	.7	15	6.9	2.0	5	5.7	1.3	6.6	1.6	21	6.8	1.6	7	5.4	.7	28	6.5	1.1
XII	2	11.5	.5	1	7.0		10.0	.5	5	6.1	2.1	3	5.0	1.3	5.7	1.7	7	7.6	1.3	4	5.5	1.3	11	6.8	1.3
Mor.		**6.9**	1.2		**4.6**	1.1	**6.6**	1.1		**5.2**	1.4		**4.7**	1.3	**5.0**	1.4		**5.7**	1.4		**4.6**	1.2		**5.4**	1.3
XIII	2	9.7	.2						9	7.3	3.0	7	6.8	2.7	7.1	2.8	11	7.7	1.6	6	6.8	2.7	17	7.4	2.1
Ave.		**6.5**	1.0		**4.2**	1.0	**5.5**	1.1		**4.9**	1.5		**4.6**	1.4	**4.9**	1.4	113	**5.4**	1.2	95	**4.6**	1.3		**5.2**	1.3

No., number of patients included in averages (Ave.). M. V., mean variation (The M. V.'s for the children, adults, males, females and entire population are the averages of the averages for the boys, girls, men and women considered separately). Mor., morons. Of the 33 tested below Age VII, only six could reproduce anything; the average for five in Age VI was 3.3.

adults. The gains with advancing years apparently are greatest for the girls and children, while the difference between the high and the low grade groups is greatest for the males and the children.

(2) There is a fairly regular, although slightly diminishing, increase in the capacity with each rising B.-S. age.

(3) Accordingly, the test is of value for mental classification and for checking the accuracy of intelligence scales.

(4) The B.-S. scale fares fairly well under the scrutiny of this test.

Facts Reproduced in the Reading Test.

The number of facts retained in the reading test likewise increases regularly (Table XVII, Graph V), with one exception each among the boys, girls, women and children; two among the men and adults, and none for the general population. The increase ranges from 2.1 at Age VII to 7.4 at XIII, a difference of 3.1 memories. The gains for each successive age from VIII to XIII are, for the entire population: 1.6, 1.1, 0.5, 1.2, 0.3 and 0.6. The figures in the separate columns are as follows:

TABLE XVIII.

Gains or Losses with each B.-S. Age in the Number of Units Reproduced in the Reading Test (the figures indicate the difference between a given age and the next previous age, based on Table XVII.)

B.-S. Age.	Boys.	Girls.	Children.	Men.	Women.	Adults.	Males.	Females.
VIII	2.4	.4	1.5	1.9	1.1	1.4	2.0	1.0
IX	.8	1.9	1.2	1.9	1.0	1.4	1.5	1.2
X	3.3	— .3	2.1	—1.0	.3	.3	.8	.1
XI	—1.4	.4	— .7	2.6	.9	2.0	1.0	.8
XII	4.9	2.3	3.9	— .8	— .7	.9	.8	.1
XIII	—1.8			1.2	1.8	1.4	.1	1.3
Ave.	1.3	.94	1.8	.96	.7	1.2	1.0	.75

The increase in retentiveness thus varies considerably from age to age and group to group. The largest average improvements from VIII to XIII are made by the boys, adults and the males. This coincides with the highest memory efficiency, as determined by the number of units retained: the boys surpass the girls (in five of six ages and in the averages); the children the adults (only in two of five ages, but the averages are higher); the men the women (in four of seven ages and in the averages), and the males the females (in six of seven ages and the averages).

These facts suggest the following *conclusions:*

(1) The ability to reproduce prose (read by the subject) varies with the sex and the period of life. Here the males and the adults excel in the average amount of improvement from year to year, and the males and the children in the absolute number of units reproduced.

(2) There is a diminishing, though not entirely regular, increase with each increasing B.-S. age.

(3) The irregularities found in the age curve in the various columns are due either to the fewness of the subjects, to the peculiarities of the groups (epileptics), or to defectiveness in the B.-S. classification. In general, however, the results speak more strongly for the validity of the B.-S. scale than against it.

(4) The test, in any case, is a valuable test for purposes of diagnosis or classification. Whether it is preferable to base the number of facts reproduced on the *logical* units, following B.-S., or on *phrase* or thought unities, has not yet been determined. The scoring can be made both qualitative and quantita-

tive. Possibly the best plan is to base the scores on single-idea unities, and scale the scores according to the relative significance of the items (a combined qualitative and quantitative measure).

Manuometry.

The strength of grip (Table XIX) likewise increases with the degree of intelligence, although the gain with these patients is by no means always regular, as is most easily seen by referring to Graph VII. For the right hand there are four exceptions each for the general population, boys and girls; three each for the men and adults, and two each for the children and women. For the left hand there are four exceptions among the women and girls, three among the men and adults, two among the boys and entire population, and one among the children. Apparently the gains are more consistent for the left than for the right hand, and for the children than for the adults. By tabulating, as in Table XX, the amount of the gains and losses in each age from V to XIII, we not only see more readily the irregularity of the increase from age to age, but we also perceive that the sums of the average gains for the boys, girls, men and women, after the losses have been deducted, are somewhat larger for the right than for the left hand (8.4 as against 5.5 kg., whence the more intelligent, the stronger relatively is the right hand); that the children gain more relatively with the right hand than do the adults; that the boys gain relatively more with the left, but the girls with the right hand; that the men gain more than the women, and that in all cases the strength of both hands is less for the XIII-year-olds than for the XII-year-olds.

TABLE XIX.

Strength of Right and Left Hand Grip (with Smedley's Dynamometer).

H.S.	Boys				Girls					Children				Men					Women					Adults					Entire Population				
Age.	No.	R.Kg.	M.V	L.Kg.	M.V.	No.	R.Kg.	M.V	L.Kg.	M.V.	R.Kg.	M.V	L.Kg.	M.V.	No.	R.Kg.	M.V.	L.Kg.	M.V	No.	R.Kg.	M V	L.Kg.	M V	R.Kg.	M V	L Kg.	M V	R.Kg	M V	L.Kg.	M V
III	3	20.	10.6	17.3	8.2	3	14.8	10.1	11.6	7.2	17.4	10.3	14.5	7.7	4	35.2	9 7	31.5	12.5										24 5	10.1	21.3	9.3
IV	4	21.5	7.	19.1	4.8	4	8.7	1.9	10.2	4.2	15.1	4.4	14.6	4.5	2	24.5	2.5	26.0	7	5	16.1	6.3	17.9	6.0	18.5	4.4	20.2	6.5	16 7	4.4	17.2	.5.5
V	1	20.		20.		2	20.	7.0	22.2	1.7	20.0		21.5		3	40.0	4.0	36.6	1.5	4	19.6	3.6	21.6	3.6	28.3	3.8	28.0	2.5	23.8	4.9	26.1	4.0
VI	3	24.6	6.8	24.6	8.2	5	15.6	5.9	18.6	6.4	19.0	6.3	20.8	7.3	6	42.6	5.4	40.1	8.1	5	22.4	5.6	25.7	5.7	33.4	5.5	33.5	6.9	27.3	5.9	28.2	7.1
VII	3	27.6	1.5	32.3	8.4	5	23.	7.6	22.4	7.7	24.7	4.5	26.1	8.0	6	36.	5.4	38.1	4.2	12	24.2	4.9	25.7	4.8	28.2	5.1	29.8	4.5	27.1	4.8	28.7	6.2
Im.		**22.7**	6.6	**22.6**	7.4		**16.4**	6.5	**17.0**	5.4	**19.2**	6.4	**19.5**	6.9		**35.6**	5.4	**34.4**	6.6		**20.6**	5.1	**22.7**	5.0	27.1	4.7	**27.9**	5.1	**23.9**	6.0	**24.3**	6.4
VIII	7	27.4	9.6	28.	9.7	6	22.5	3.9	23.8	2.5	25.1	6.7	26.1	6.1	17	40.5	5.5	41.6	7.3	15	24.5	4.1	25.2	4.2	33.0	4.8	33.9	5.7	30.7	5.7	31.6	5.9
IX	6	32.	7.3	33.6	7.5	3	23.3	5.7	20.	7.0	29.1	6.5	29.	7.2	9	43.8	4.8	44.4	4.0	8	28.7	2.2	29.2	3.2	36.7	3.5	37.2	3.6	34.0	5.0	34.4	5.4
X	14	38.4	8.3	38.2	8.3	7	24.7	6.5	24.3	6.4	33.8	7.4	33.6	7.3	20	44.4	5.1	46.8	5.8	29	28.0	5.1	28.2	5.7	34.7	5.1	35.8	5.7	34.4	6.2	35.1	6.5
XI	5	36.2	7.4	38.7	7.3	2	28.2	.2	29.5	.5	33.9	3.8	36.0	6.1	12	46.3	6.4	46.9	5.3	5	28.2	3.4	26.3	4.1	41.5	4.9	41.5	4.7	39.5	4.3	40.0	5.4
XII	2	45.2	.2	45.2	3.3	2	36.		27.0		42.1	.2	39.1	3.3	5	49.8	3.1	48.3	5.5	3	33.6	1.6	32.3	3.1	43.6	2.3	42.3	4.3	39.1	1.6	41.4	3.8
Mor.		**35.8**	6.5	**36.7**	7.2		**26.9**	4.1	**24.9**	4.1	**32.8**	4.9	**32.7**	6.0		**44.9**	5.0	**45.6**	5.6		**28.6**	3.3	**28.2**	4.0	37.9	4.1	**38.1**	4.8	**35.5**	5.7	36.5	5.4
XIII	2	33.7	12.7	37.	11.										9	47.9	6.8	45.8	6.0	7	25.	3.5	24.7	4.0	37.9	5.1	36.6	5.0	37.4	7.6	36.6	7.0
Ave.		**29.6**	7.1	30.6	7.6		**21.6**	5.4	**20.9**	4.8	**26.0**	5.5	**26.1**	6.4		**41.0**	5.3	**40.5**	6.1		**25.**	4.0	**25.6**	4.4	**33.5**	4.4	**33.8**	4.9	30.4	6.0	**30.9**	6.0

R.Kg., L.Kg., strength of right and left hands in kilos.

TABLE XX.

Gains or Losses made in Strength of Grip with each B.-S Age. (The figures represent the difference in kg. between a given age and the next preceding age.)

	Boys		Girls		Children		Men		Women		Adults	
Age.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.
V	— 1.5	.9	11.3	—3.6	4.9	6.9	15.5	.6	3.5	3.7	9.8	7.8
VI	4.6	4.6	— 4.4	3.8	—1.0	— .7	2.6	3.5	2.8	4.1	5.1	5.5
VII	3.0	7.7	7.4	1.4	5.7	5.3	— 6.6	—2.0	1.8	.0	—5.2	—3.7
VIII	— .2	4.3	— .5	—3.8	.4	.0	4.5	3.5	.3	— .5	4.8	4.1
IX	4.6	5.5	.8	4.3	4.0	2.9	3.3	2.8	4.2	4.0	3.7	3.3
X	6.4	4.7	1.4	5.2	4.7	4.6	.6	2.4	— .7	—1.0	—2.0	—1.4
XI	— 2.2	.5	3.5	—2.5	.1	2.4	1.9	.1	.2	—1.9	6.8	5.7
XII	9.0	6.5	7.8				3.5	1.4	5.3	6.0	2.1	.8
XIII	—11.5	—8.2			8.2	3.1	— 1.9	—2.5	—8.5	—7.6	—5.7	5.7
Ave.	1.4	3.0	3.4	.7	3.5	3.0	2.6	1.1	1.0	.7	1.0	3.1

It would be important to know how far these peculiarities or irregularities are due to the small number of subjects tested in certain ages.

The difference between Ages III and XIII for the entire population is 12.9 for the right hand and 15.3 kg. for the left hand; the corresponding differences between the imbecile and moron groups are 11.6 and 12.2. That the gain of the morons over the imbeciles is not uniformly greater for the left hand is seen from the following tabulation:

TABLE XXI.

The Amounts in Kg. by which Morons excel Imbeciles in Strength of Grip (based on Table XIX).

	Right Hand.	Left Hand.
Boys	13.1 kg.	14.1
Girls	10.6	7.9
Children	13.6	13.2
Men	9.3	11.2
Women	8.0	5.5
Adults	10.8	10.2

The gain of the high-grade over the low-grade patients is relatively larger for the boys than for the girls, and for the children than for the adults.

With respect to the comparative strength of the right and the left hands, the evidence is conflicting. The general average for the left hand is .5 kg. higher (index of right-handedness = 1.01%). It is higher for the boys (index = 1.03%) and women (index = 1.02%), and lower for the girls (96%) and men (98%). Among the morons it is higher for the boys (1.02%) and men (1.01%), and lower for the girls (92%) and women (99%); and among the imbeciles higher for the girls (1.03%) and women (1.10%), and lower for the boys (99%) and men (96%). The index is about the same in the two groups. The aver-

ages for the boys are higher for the left hand in five individual ages, lower in three, and equal in three: for the girls they are higher in half the ages; for the men, higher in six ages and lower in five; for the women, higher in seven and lower in four; for the children, higher in half the ages, and for the adults they are higher in six ages and lower in four. It is apparent, therefore, that the left-hand grip is stronger in some epileptics and the right-hand grip in others, with the odds rather in favor of the left hand. It has been claimed that degenerates have a stronger left-hand grip, but the rule is by no means invariable, at least so far as epileptics are concerned. For normals the right-hand grip has been found superior, the index varying from 81 to 96%. This contrasts with our index for the entire population, 1.01%. But there are probably exceptions among normal persons also.

If the dynamometry results leave us in doubt regarding some points, the superior strength of the epileptic boys and men is unmistakable, just as among normal persons. There is no significant exception in any column. The superiority of the boys, compared with the girls, amounts to 8 kg. for the right hand and 9.7 for the left, and the superiority of the men, compared with the women, amounts to 16 and 14.9 kg. for the two hands, respectively. The difference is not only large, but the male superiority is relatively greater among the men than among the boys. Among normals, likewise, it has been found that the divergence grows more marked from the time of puberty.

Likewise the difference between the moron males and females is greater than between the imbecile

males and females, as indicated by these figures: the right and the left-hand grips of the boy imbeciles surpass those of the girl imbeciles by 6.2 and 5.6 kg.; for the adults the corresponding figures are 15.0 and 11.7. But the grips among the boy morons exceed those of the girl morons by 8.9 and 11.8; the corresponding figures for the adults are 16.3 and 17.3 kg. Analogous results, I believe, obtain among young and old normal children. In the imbecile group the difference is greater for the right than the left hand, while the reverse is the case among the morons. The sex-difference is thus less in the young and the intellectually inferior than in the more mature and intellectually superior.

Another unmistakable fact is the superior strength in all the groups of the adults as compared with the children. In the general averages this superiority amounts to 7.5 and 7.7 kg. for the right and left hands, respectively; in the moron group the corresponding differences are 5.1 and 5.4, and in the imbecile group 7.9 and 8.4 kg. It thus appears that many epileptics grow physically stronger as they pass from childhood to adulthood. How long this increase continues among normal persons has not been determined.

Summarizing, we may say:

(1) The dynamometer test reveals significant sex and maturity differences, and differences between the right and left hands. The males are stronger than the females, whether epileptic or normal; the adults and the morons among epileptics relatively more so than the children and the imbeciles. The absolute strength is greater for the adults and morons: the younger and inferior (lower grade) are relatively

nearer together than the older and intellectually superior. The left-hand grip is stronger with some epileptics, the right with others; but altogether the left hand is apparently slightly stronger, as seen most clearly in Graph VII. The index, 1.01%, is quite different from the normal index, from 91 to 96%. It is seen that the epileptics approximate a condition of ambidextrality, just as dull and feeble persons do. The latter have "two left hands" (Binet and Vaschide). A positive correlation has also been asserted between dextrality and intellectual ability for normal children (Smedley).

(2) There is an increase in the strength of grip with increasing B.-S. ages, but the increase from age to age is not entirely regular. This indicates either that the B.-S. classification is not entirely correct, or that epileptics do not follow the rule obtaining among normal persons, who show an increase with each chronological age (Smedley), or that the irregularities may be due to the fewness of the patients in some ages. The gains with increasing age are greater for the boys than for the girls, for the children than for the adults, and for the right than for the left hand (although the difference between the low grade and the high grade subjects appears to be greater for the left hand).

(3) Our results are in harmony with the finding for public school children, that the most intellectual are the strongest (Carman, Smedley, Schuyten).

(4) Dynamometry is a valuable test for purposes of diagnosis; its value for purposes of mental classification and for testing the accuracy of intelligence scales needs to be determined with greater accuracy with normal persons. So important has the grip

(hand grasp) of an individual been considered that Barr regards it as more indicative of capacity than the language test: hand grasp and mental grasp go hand in hand (*Mental Defectives,* 1910, p. 162).[1]

Ataxiagraphic Sway.

An examination of Table XXII and Graph VIII shows that there is diminution with increasing B.-S. age of the bodily sway, both lateral and antero-posterior, but that this diminution is by no means regular from year to year. Nevertheless, if we examine the averages for the two groups, we find that the sway is less for the morons than for the imbeciles, with one exception (females, eyes shut). From Table XXIII, it appears that the group difference will vary from nearly zero to almost 20 mm., that the difference in absolute terms is larger with the eyes shut than with the eyes open (one exception), that the difference for antero-posterior is larger than for the lateral sway, and that the sex-difference is only apparent with the eyes fixated.

TABLE XXIII.

Amounts by which the Ataxiagraphic Sway of Imbeciles exceeds that of Morons (based on Table XXII).

	Eyes shut		Eyes fixated	
	A.-P. Mm.	Lat. Mm.	A.-P. Mm.	Lat. Mm.
Entire population	16.9	14.8	11.6	7.7
Males	13.5	12.0	9.1	21.9
Females	15.0	12.1	15.1	— .8

From Table XXIV, which gives the difference between the absolute sway of the males and the females (a positive number indicating that the sway

[1]In a later contribution the dynamometry data will be tabulated according to chronological ages and compared with normal performances.

TABLE XXII.

Ataxiagraphic Sway.

	MALES.								FEMALES.								ENTIRE POPULATION									
	Eyes Shut				Eyes Fixated				Eyes Shut				Eyes Fixated				Eyes Shut				Eyes Fixated					
B.-S.	A.-P.		Lat.		A.-P.		Lat.		A.-P.		Lat.		A.-P.		Lat.		A.-P.		Lat.		A.-P.		Lat.		No.	No.
Age.	Mm.	M.V.	Mm.	M.V.	Mm.	M.V.	Mm.	M.V.	Mm.	M.V.	Mm.	M.V.	Mm.	M.V.	Mm.	M.V.	Mm.	M.V.	Mm.	M.V.	Mm.	M.V	Mm.	M.V.	M.	F.
III	36.5	15.5	46.5	20.5	57.5	9.5	47.5	13.5																	2	
IV	77.5	17.5	45.0	3.0	70.5	8.5	80.0	31.0	78.	6.0	90.	18.	72.5	7.5	63.5	21.5	77.7	11.7	67.5	10.5	71.5	8.0	35.8	26.2	2	2
V	79.		87.		78.		69.		72.		43.		61.		51.		75.5		65.		69.5		60.		1	1
VI	74.	15.5	48.7	14.7	56.5	8.7	48.	11.5	68.5	13.5	60.	12.	94.	18.	60.7	15.1	71.2	14.5	54.3	13.3	75.2	13.3	54.3	13.3	4	4
VII	87.2	23.2	64.	23.	50.	10.5	69.5	25.	66.3	20.4	53.8	19.7	39.8	14.7	35.5	9.5	74.7	21.8	57.9	21.3	43.9	12.6	49.1	17.2	4	6
Im.	70.8	17.9	58.2	15.3	62.5	9.3	62.8	20.2	71.2	13.3	61.7	16.5	66.8	13.4	52.6	15.3	74.7	16.0	61.2	15.0	65.0	11.3	49.8	18.9		
VIII	54.5	12.1	49.3	12.8	49.2	14.1	43.5	13.1	67.3	28.9	57.6	23.4	54.6	20.6	49.1	12.6	58.1	20.5	51.6	18.1	50.7	17.3	45.0	12.8	18	7
IX	68.	24.2	50.9	11.3	65.1	20.7	52.1	11.8	79.	2.0	56.	21.3	63.3	8.2	70.6	32.8	70.2	13.1	51.8	16.3	64.8	14.4	55.6	22.3	13	3
X	55.2	19.1	51.6	27.7	47.6	13.	37.4	11.9	58.	19.8	44.4	8.7	53.2	13.9	40.9	12.6	56.0	19.4	49.5	18.2	49.2	13.4	38.4	12.2	31	13
XI	45.5	12.1	35.5	10.1	49.3	20.5	33.1	10.7	42.	1.0	40.5	15.5	36.	15.0	53.	23.0	45.1	6.5	36.	12.8	47.8	17.7	35.3	16.8	16	2
XII	63.4	20.3	43.8	16.7	56.1	15.3	38.8	7.8	35.		39.		45.		20.		59.8	20.3	43.2	16.7	54.7	15.3	36.5	7.8	7	1
Mor.	57.3	17.5	46.2	15.7	53.4	16.7	40.9	11.0	56.2	12.9	49.6	17.2	51.7	14.4	53.4	20.2	57.8	15.9	46.4	16.4	53.4	15.6	42.1	14.3		
XIII	47.	10.	35.6	9.3	49.	13.	36.	9.6	54.		42.		25.		32.		48.	10.	36.5	9.3	45.5	13.0	35.4	9.6	6	1
Ave.	62.5	16.9	50.7	14.9	57.1	13.3	50.4	14.5	62.0	13.0	55.6	16.9	59.3	13.9	53.0	18.1	63.6	15.3	51.3	15.1	57.2	13.8	44.5	15.3		

A.-P., antero-posterior sway. Lat., lateral sway. Mm., millimeters. M., males. F., females.

is larger for the females; a negative, larger for the males), it appears that, while the difference between the sexes is not very considerable in most cases, the sway is larger for the females than for the males.

TABLE XXIV.

Sex Differences in Ataxiagraphic Sway (based on Table XXII).

	Eyes shut		Eyes fixated	
	A.-P. Mm.	Lat. Mm.	A.-P. Mm.	Lat. Mm.
Average of all ages.....	— .5	4.9	2.2	2.6
Morons	—1.1	3.4	—1.7	12.5

Explanations of signs above.

The exceptions are the antero-posterior sway, eyes shut, both groups; and eyes fixated, morons. This seems to show that there is an ataxiagraphic sex-difference in epileptics associated with the lateral direction (larger relatively to the antero-posterior sway for females than for males). The exceptions can be gleaned from Table XXII.

To summarize:

(1) Apparently the ataxiagraphic sway varies with the sex, and with the eyes shut and open. It is slightly larger for female than male epileptics, particularly in the lateral direction. The closing of the eyes accentuates the sway in both directions, more for the low than for the high grade cases.

(2) The antero-posterior sway is usually considerably larger than the lateral, as is strikingly apparent in the Graph VIII, for eyes fixated.

(3) The ataxiagrams are clearly smaller for the moron than for the imbecile group, so that there appears to be a difference dependent upon the degree of intelligence. But the dependence is not very precise, as the diminution of the sway from year to year is not very regular.

(4) This is a valuable test for diagnosis in vari-

ous conditions, but before we are justified in using the test for purposes of intellectual classification or for checking intelligence scales it must first be demonstrated that the bodily sway among normal persons varies with the degree of intelligence.[1]

Analysis of the Mean Variations.

As a measure of the reliability of averages or the uniformity between the separate counts, whether averages or single determinations, which make up a series of determinations, we may use the mean variation (M. V.). The reliability of the central tendency varies inversely with the size of the relative M. V. If the M. V. is large in relation to the size of the average (*i. e.,* if the *relative M. V.,* or *coefficient of variability,* is large), the average possesses little reliability. Likewise, if the measurements of a given trait from numbers of subjects grouped in the same mental age vary considerably, it follows that the test in question is not properly placed (not well attuned to its correct age) or that the variation is normally so large for the given trait that the test is worthless as a *norm* for a given age. It is clear that, in the very nature of the case, a norm is normative by reason of the fact that it indicates, within a certain range of variability, the expected performance for the age to which it is assigned. The larger the variability, the larger is the uncertainty of the norm; if the variability is as large as the average, the latter, of course, fails utterly to represent any central tendency. At the same time, one must recognize that mental meas-

[1]In a later publication the ataxiagraphic data will be tabulated according to chronological age, and compared with the ataxiagrams for normal persons.

urement is concerned with the determination of tendencies, not of absolute constants, and that a certain degree of variability of performance is thus perfectly normal.

The M. V. of a series of determinations is not very reliable unless the series contains a reasonable number of observations. Because our number of subjects is small in some of the ages, it will be advisable to confine the analysis to the larger averages. The details may be left to the reader to glean from the tables.

The coefficient of variability in the time required to name the *four colors* amounted to 28% for the entire population, 26% for the boys, 36% for the girls, 39% for the women, and 57% for the men. In the amount of irregularity the boys rank highest and the men lowest. The M. V. is larger for the imbeciles than for the morons. The variation is considerable in all the ages, and in Age VIII, in which the test is placed, it is even larger (37%) than for the general average.

The coefficient of variability in the time needed to utter *sixty words* amounted to 25% for the entire population, 18% for the boys, 22% for the women, 28% for the girls, and 33% for the men. Here, again, the boys are the most regular and the men the least. The M. V. is considerable in most of the ages, and in Age XI, to which the test is assigned, it amounts to 24%, as compared with 13% for Age XII, the age to which it has been transferred in Binet's latest revision, and the age in which it is satisfactorily passed by our patients.

The coefficient of variability in *reading capacity,* based on time, amounted to 28% for the entire popu-

lation and for the women, 26% for the girls, 29% for the boys, and 31% for the men. While the male sex appears to be the most variable, the differences are not very material. The amount of the variation differs greatly in the different columns, but it is usually considerable in each age. In the ages in which the test is placed, VIII and IX, the coefficients are considerably larger than any of the above figures, namely, 41 and 50%, respectively. Even in Ages X, XI and XII, the coefficients amount to 60, 31 and 42%, so that while the average reading *time* diminishes with age, the variation among individuals continues large—a fact of common observation.

That the amount of irregularity is partly due to the presence of a few very slow readings is indicated by the fact that the medians are uniformly and considerably smaller than the averages in Ages IX, X, XI and XIII.

The coefficient of variability in *memory capacity* (memories from reading test) is 25% for the entire population, 15% for the boys, 24% for the girls, and 30% for the men and women. This points to a greater regularity, or homogeneity, of memory-capacity among the boys and a less regularity among the adults. In this respect the epileptic adults are obviously much like the senile adults among normal persons. We have already seen that memory capacity among the children, as measured by the number of units retained, excels that of the adults. The size of the M. V.'s varies a great deal in the various ages and columns. The coefficient is 27% in Age VIII, in which the average number of memories is 3.7, instead of 2 as required by B.-S., and 27% in Age IX, in which there are 4.8 memories instead of six as re-

quired by the scale. This indicates (1) that the difference in reproductive capacity between VIII and IX is not so large as indicated in the scale, at least for epileptics, and (2) that the variation for these ages is even larger than for the general average. On the other hand, the coefficients of variability in Ages XI and XII are only 17 and 19%, respectively.

The variability in the test of motor performance—the *form-board* — amounted to 24% for the entire population, 25% for the women, 27% for the boys, 39% for the men, and 47% for the girls. Here the greater regularity in the boy and woman groups is manifest. The same truth appears if we confine the comparison to the morons: boys, 16%; women, 16%; men, 17%, and girls, 21%. The differences are slight, however. It is noticeable that the absolute M. V. is considerably smaller (at least in two cases) for the morons than for the imbeciles, and that the absolute M. V. decreases markedly with age. The exceptions are probably due to the fewness of the subjects. The variability is 14% for Age IX, 18% for Age X, 10% for Age XI, and 7% for Age XII. If we assume that the regularity of performance of a given activity increases with age, it appears that the patients are fairly well classified.

The coefficients of variability for the right and left hand grips are shown in Table XXV.

TABLE XXV.

Coefficients of Variability in Hand Dynamometry.

	Right.	Left.
Entire population....	20%	20%
Boys	24	24
Girls	25	23
Men	13	15
Women	16	17

It appears that the irregularity is about the same for the right and left hands, for the girls and boys, for the men and women, and considerably less for the adults than for the children. The coefficient is considerably less for the morons than for the imbeciles, the percentages for the right hand being, respectively, 16 and 25, and for the left hand 14 and 26. (Among normals the variability has been found greater in early adolescence than at any other time.)

The relative M. V.'s for the body sway are shown in Table XXVI.

TABLE XXVI.

Coefficients of Variability in Ataxiagraphic Sway.

	Eyes shut		Eyes fixated	
	A.-P.	L.	A.-P.	L.
Entire population	24	29	24	34
Males	27	29	23	28
Females	21	30	33	34

It is seen that, without exception, there is among these patients less relative variation in the antero-posterior than in the lateral sway; that the variation is not materially different, whether the eyes are closed or fixated, and that the differences between the males and the females do not seem to follow any rule.

General Conclusions and Comparisons.

1. In most of the above tests there are *maturity* differences, that is, differences between the period of childhood and adulthood. The epileptic children excel in the color test (better average and lower M. V.), the 60-word test (better average and better gains), and the memory test (higher average and lower M. V.); and the adults excel in the reading test (better average), the form-board test (better

average), and the dynamometer test (better average and lower M. V.). Accordingly, an adult who grades, say, X years mentally is not the same intellectually as a child with a X-year mind. The results, however, seem to show that the differences are not so large but that a common scale can be legitimately used for both children and adults—unless, indeed, the differences are larger among normal than abnormal persons.

Whether the adults attain a *higher intellectual station* cannot be determined reliably from the data in this chapter, but must be ascertained from the *table of distribution* in Chapter I. In this table it appears clearly that the adults reach a higher status: there are appreciably more child than adult idiots (3.7% more) and imbeciles (14.3%), but appreciably less child morons (11.8%) and normals, retardates or deviates (5.3%).

The inference from the mere curve of distribution, however, involves a certain source of error, because there are nine children chronologically less than thirteen years of age who do not grade as feeble-minded by the B.-S. scale (that is, they are retarded less than three years). These children, therefore, belong to the group of normals or deviates, but could not be so classified because they failed to satisfy the thirteen-year standard. But it is probable that if due allowance is made for this error, the conclusion will still stand that the adults are intellectually superior to the children. It would thus appear that *the average epileptic, in spite of the dementing tendency of the disease, makes intellectual progress from childhood to adulthood*—unless, perchance, the onset of the attacks occurred late in life or unless the attacks were

more than ordinarily light in the case of this group of adults, both of which suppositions are improbable. From this fact we may conclude that *institutions for epileptics should be made genuine training schools, not mere asylums.*

2. There are likewise *sex* differences in most of these traits. The females excel in the color test (in average speed, although the M. V. is less for the boys), the reading test (average and M. V.), and the 60-word test (average, and gains for girls; but the men also have a high average), and the males excel in the form-board test (particularly in the average for the high-grade patients, and in the average and M. V. for the boy morons; but the women also have a low M. V.), the memory test (average, and M. V. for boys), the dynamometer test (average, and also gains for boys), and the ataxiagraph test (average extent of sway). It is seen that the epileptic males excel in more tests than the epileptic women, and that the best single group is that of the moron boys.

These results are confirmed by three other facts. First, by the table of distribution (Chapter I), which contains a larger percentage of high-grade males than females. Although there are slightly more male than female idiots (.7% more), the male imbeciles are fewer (by 7%), while the male morons (by 4.8%) and male retardates (1.4%) are more numerous. Likewise if we consider the separate columns, there are less men than women idiots (by 2.1%) and imbeciles (by 2.4%), but more men morons (by 3.1%) and retardates (by 1.3%); and there are more boy than girl idiots (by 5.7%), but decidedly less boy im-

beciles (by 20.8%) and decidedly more boy morons (11.5%) and retardates (3%). The obvious superiority of the boys is confirmed by the above figures, although a relatively large percentage of the idiots are boys.

A second means of corroboration is to determine the relative station of the boys and girls by calculating the number of *years of retardation* for each child, that is, the number of years between the child's chronological age and his B.-S. age. This could not very well be calculated for the adults, partly because the B.-S. scale does not extend beyond Age XIII (we have no other satisfactory tests for the higher ages that have yet been standardized), and partly because the attempt would involve a certain absurdity. Let us assume that two adults, respectively 30 and 40 years old, just grade XX years by a serial intelligence scale. We should not thereby be able to say that the 30-year-old is retarded 10 years intellectually in the same sense in which a 13-year-old grading III years is retarded 10 years, since the increase in intellectual capacity from 20 to 30 would very probably not amount to 10 years. It would be less than the difference between 3 and 13. Nor, again, should we be able to say that our 40-year-old was retarded twice as much as our 30-year-old, for ordinarily for the average person there is probably little increase in intellectual strength from 30 to 40 (there would, of course, be a great increase in erudition on the part of the studious). Hence, our 40-year-old would be retarded only slightly more than our 30-year-old.

Furthermore, in restricting the following tabulation to the children, it is well to point out certain possible errors. The amount of retardation is probably somewhat exaggerated in the case of those who pass the tests of the higher ages, as the norms are probably too difficult. Nor, following the above reasoning, does a unit of retardation mean exactly the same thing throughout the scale. The difference between, say, Ages II and III is larger than between Ages XII and XIII. A 20-year-old person who passes only Age XII, and a 12-year-old child who passes Age IV, would both be rated as eight years retarded, but the eight years from 4 to 12 almost certainly represent a larger difference than the eight years from 12 to 20. Moreover, the retardation is probably exaggerated for the few who pass Age XIII, because these few might have gone higher, but there was no means of determining this by the scale.

In Table XXVII the children are arranged in their *chronological* (actual) ages from 5 to 20, and the average amount of retardation is given in years for the patients of the same chronological ages. In Table XXVIII the amount of retardation is averaged for the children in each B.-S. age. The grouping in Table XXVII is based on chronological age, and in Table XXVIII on B.-S. ages.

Here we see that the boys are retarded less than the girls: in Table XXVII by 0.8 of a year for the general average and by 0.9 for the average of ages 14 to 20 (with only two exceptions in the individual ages); and in Table XXVIII by one year for the general average (with three exceptions in the individual

TABLE XXVII.

Years of B.-S. Retardation for Epileptic Children in each Chronological Age.

Chron. Ages	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Boys	3	4	4	5	3	0	3.6	2.4	6.2	6.5	8.0	5.6	6.9	9.7	12.2	13.0
Girls		2				5	5.2	6.0	3.0	10.0	6.5	7.0	8.4	10.1	12.5	13.6
Average		3				2.5	4.4	4.2	4.6	8.2	7.2	6.3	7.6	9.9	12.3	13.3

Chron., chronological. Average amount of retardation: for ages 1 to 13, boys 3.4, girls 4.2; for ages 14 to 20, boys 8.8, girls 9.7; and for ages 1 to 20, boys 5.8, girls 6.6 years.

TABLE XXVIII.

Retardation in Years of Epileptic Children in each B.-S. Age.

B.-S. Ages	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	Av.
Boys	14.	7.5	11.	10.2		6.	8.	6.	6.	5.4	4.6	5.5	3.	7.2
Girls		11.0	11.3	8.0	10.6	9.8	10.	7.	3.3	5.0	6.			8.2
Average		9.2	11.1	9.1		7.9	9.	6.5	4.6	5.2	5.3			7.7

The data above on mental retardation will be compared in another connection with other data on pedagogical retardation.

ages). The superiority of the boys, whichever method of tabulation is considered, thus amounts, in round terms, to one year.[1]

Finally, if we average the M. V.'s in all tests (ataxiagraphic excepted), we get the following results:

Boys.	Girls.	Children.	Men.	Women.	Adults.	Males.	Females.
23.1	30.9	27.0	34.0	26.7	30.3	28.5	28.8%

There is no difference between the males and females, although the men are inferior and the boys distinctly superior.

Altogether we may say, then, with confidence, that *the males, and particularly the boys, in this group of epileptics, are superior to the females* — a fact of common observation at the institution. Further study would determine whether this conclusion is valid for epileptics generally. The conclusion is obviously of interest, because, so far as concerns the children, one would expect the girls to surpass the

[1]Attention may be directed incidentally to a number of other facts which appear in the above tables. Thus the amount of retardation in general becomes greater as the child grows older, which is evident from the fact that the figures grow larger in the higher chronological ages in Table XXVII. This indicates a progressive loss of intelligence with increasing age, relative to the normal improvement, quite analogous to the progressive loss in manuometry exhibited by juvenile delinquents—unless, forsooth, this loss can be accounted for by the considerations advanced above. It seems natural that the normal child should outstrip the defective more and more, so that the gap between them becomes progressively larger.

On the other hand, the loss with increasing B.-S. ages becomes less and less, the average for Ages I to VII (idiots and imbeciles) being 10.1 and for Ages VIII to XIII (morons and retardates), 5. The progressive loss here is, no doubt, due to the fact that few children at the institution were under seven years of age.

The feeble-minded status of the group is emphasized by the fact that the average amount of retardation is over 7 years. Yet there were 4 girls and 5 boys who were merely backward (retarded less than three years).

boys, since they mature earlier, and because it does not square with public-school statistics of retardation, promotion, elimination and repetition. A study of fifteen city school systems showed that there were more retardates and repeaters among the boys than among the girls (13% more of each), and a larger percentage of elimination (17%) and non-promotion (Ayres). Either these findings do not apply to epileptic children, or otherwise our group has been specially selected in some way. Apparently the disease (epilepsy) plays greater intellectual havoc with girls than with boys.

On the other hand, our findings agree with the generalization that there is a *larger percentage of males at both extremes of the human scale*—more very low-grade men (idiots) than low-grade women, and more very high-grade men (geniuses) than high-grade women. The Germans, it is said, have a name for boy geniuses, but not for girl geniuses.

Having these sex-differences in mind, a question of moment confronts us: *Can we measure the intelligence of boys and girls accurately by the same scale?* It would be unwise to attempt to answer this question on the basis of our results with epileptics. It is enough to say that our results emphasize the necessity of a thorough experimental study of the question.

3. The results indicate that *the B.-S. scale is rather more satisfactory than appeared from the facts adduced in Chapter II.* While it does not scale different grades of intelligence with the degree of accuracy which would be desired, it *does enable us to grade and classify defective individuals far more rapidly and satisfactorily than would be possible*

by the ordinary methods of observation. The facts which perhaps tell more strongly against than for the accuracy of the scale are the averages in the color, dynamometry and ataxiagraphic tests, and the coefficients of variability. The latter range from 15% to 57%, and average almost 30%. Mental measurements, of course, are always variables, but the variations in our results seem to be rather too large. In many psychological measurements a variation of from 10 to 15% is considered large. Perhaps we may fix 25% as the maximal permissible coefficient of variability. *But we need to determine by experimental means what should constitute a normal or maximal coefficient of variability for normal age-groups* (normal persons). At the present time we are unable to assign any definite value to the *age norm of variation* (M. V. norm).[1] No one, however, need be deterred from using the scale before this work has been done. Whatever its imperfections, it affords a *practical, easily administered, objective, systematic method of grading defective children and adults,* which, while not as yet maximally accurate, *approximately locates the mental station of the individual.* At the same time we must not blind our-

[1]Courtis tested 23 eighth-grade pupils, the survivals of eight years of "passing" on a 70% basis (and therefore presumably closely graded), and found the relative M. V.'s to amount to 18% in an addition speed test, "3% in age, 7% in handwriting, * * * 15% in formal English grammar, 26% in height, 30% in memory of important dates and men, 60% in ability to reproduce after 24 hours the main points of a historical passage read once in class" (S. A. Courtis, Measurement of Growth and Efficiency in Arithmetic, *The Elementary School Teacher*, II: 1911, p. 533). We shall be in no position to pass on the efficiency of the *grading* in graded schools until we have *grade-norms of variability* similar to the *age-norms* of which we have spoken above. In a serial investigation during the past year of various mental traits, I found surprisingly large M.V's, both in respect to the *age* and *grade* standards.

selves to the necessity of revising and improving the scale.

4. The data presented here will help us to a better understanding, not only of epileptic and other types of abnormal minds, but of normal persons as well, as soon as similar data are obtained from other surveys. Here we can take space for three brief comparisons only.

According to B.-S., the time required to *read the fifty-three words* about a fire was as follows for the ages indicated: Age VIII, 45 sec.; IX, 40 sec.; X, 30 sec.; and XI, 25 sec. Comparison with the corresponding ages in Table XI shows that the epileptics of VIII, IX and X required considerably more time (the times were 86.5, 61.9 and 44.6 sec., respectively), while the XI-year-old epileptics required about the same amount of time—indeed, if we consider the medians, the time was actually shorter for the X- and XI-year-old epileptics than for the normals. Here is probably a *specific retardation effect incident to the disease* (epilepsy). The epileptic children acquire the reading art more slowly than do normal children; in fact, more slowly than the above figures indicate, because many of those who graded X and XI were chronologically from 12 or 13 to 18 or 20 years old.

The following were the seconds consumed by the feeble-minded patients at Vineland in replacing the blocks in the *form-board* for each B.-S. age (according to figures supplied directly by Goddard):

II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
150	90	70	40	35	29	20	19	19	17	15

It is seen from Table XIII that *the feeble-minded reacted more rapidly than the epileptic in all ages up*

to and including IX, in some ages very considerably faster, but that from Ages X to XII the epileptics slightly excelled. The higher-grade epileptics thus react pretty much like the higher-grade feeble-minded in the corresponding ages. It should be stated that the epileptics were tested when they were in their normal condition, and not in a state of stupor. In the latter condition the reactions would be markedly lengthened or would cease entirely.

Finally, comparison for *memory of digits* may be made with Jacob's norms for London school children. He pronounced series of digits to about thirty pupils in each age from 8 to 19. The pupils wrote what they retained. The following averages are based on the highest number reproduced:[1]

Age.	8	9	10	11	12	13	14	15	16	17	18	19
Ave.	6.6	6.7	6.8	7.2	7.4	7.3	7.3	7.7	8.0	8.0	8.6	8.6

From these figures it appears that memory norms for digits cannot be established for each age. They seem to be approximately the same for several ages: 8 to 10 (6 digits), 11 to 15 (7 digits), and 16 to 19 (8 digits). It would not be profitable at this time to enter upon a discussion of age-norms for digits in the light of these and other available data. To establish these norms upon a satisfactory basis far more children in each chronological age must be tested than has hitherto been done.

5. As may be seen by a cursory glance at the graphs, there is a *continuity of variation* in all the *single traits tested,* within the limits of the ages plotted, for epileptics. The variations cluster around

[1]Cf. G. E. Johnson, "Contribution to the Psychology and Pedagogy of Feeble-Minded Children," *Pedagogical Seminary,* 3: 1895, 268-273.

one type or *mode* (subject to certain irregularities in some of the traits), and it is entirely probable that this one-type pattern of distribution would not be altered were the records of normal subjects included. It is impossible to group these traits in epileptics into *disparate classes,* separated by intervening gaps: they vary continuously from lowest to highest. Accordingly, the epileptic is not "abnormal" in respect to these traits in the sense that he constitutes a *distinct type,* a species apart from ordinary individuals. With all his exaggerated "variation" or "individuality," he still shares with the rest of us a "common humanity," the common humanity of the race. He is not essentially different in *kind* from the ordinary person. What appears to be a *qualitative* difference is probably an *exaggerated quantitative difference,* because the traits of the epileptic fall within the *surfaces of distribution* for the human kind. He occupies the lower extreme of the surface. (It should be said that I am leaving out of the account the lowest-grade epileptics, who are not included in our "trait" curves, and that the curves may be considered only indirectly as distribution surfaces.)

In conclusion:

The great need of a simple, objective scale for intellectually grading defective school children and juvenile (also adult) delinquents, for measuring the extent of involution changes produced by dementing psychoses, and for classifying institutional cases of mental defectives of whatever kind, and the present conspicuous lack of a generally accepted or satisfactory method, is recognized on every hand. Neither the educator, the alienist, the criminologist nor the

judge have at their ready disposal a valid method for locating mental station and classifying individuals according to degree of mental defect. A graded diagnostic scale of intellectual development commends itself because of its great *practical utility,* even though less valuable for the purpose of exact scientific diagnosis. Because of the present considerable utility of the Binet-Simon scale, and its greater prospective utility, to all students who have to do with deviating individuals, no pains should be spared to ferret out its present imperfections, so that an improved scale may gradually be evolved. Until this has been done we may continue to use the present scale, confident that there is no other single instrument available which gives us a *superior preliminary survey* of a defective or mentally deviating individual—a conclusion already emphasized by the writer elsewhere.[1]

At the same time it is necessary to sound a note of warning: the function of the B.-S., or any other graded scale of intelligence, is to give us a *preliminary,* and *not a final* survey or rating of the individual who may be tested. The B.-S. testing is not to be regarded as a *finality,* but merely as a *point of departure* for further diagnosis. It gives us the *first,* and not the *final* word about an individual's mental status. Once the individual's mental station has been preliminarily and roughly determined by a graded intelligence scale, there remains the more difficult task of making a *detailed, expert diagnosis for each case and a diagnosis of each fundamental trait or capacity.*

[1]The New Clinical Psychology and the Psycho-Clinicist, *Journal of Educational Psychology,* 2: 1911, 121 and 191.

It is folly to suppose that any ordinary grade teacher who has taken a summer course in clinical psychology, or that any professional expert whatsoever who lacks technical training in psycho-clinical or psychiatric methodology, is prepared to mentally diagnose defective or deviating individuals, or to conduct psycho-clinical research, or to extend the boundaries of clinical psychology. It would be no more absurd to expect a teacher or preacher or lawyer or old-line experimental psychologist to diagnose human disease from reading a book on medical diagnosis. The idea, unfortunately, seems rapidly to be gaining ground that anyone, be he grade teacher, introspective psychologist, practicing lawyer or general medical practitioner, is able to make psychological diagnoses by putting the child through a few stock psychological tests. Nothing is more preposterous. The ability to make psycho-clinical examinations and diagnoses requires as high an order of trained skill as the ability to make neurological or general physical examinations and diagnoses. All that can reasonably be expected from grade teachers, or anyone who has not had considerable first-hand experience in the mental examination of various kinds of mental defectives, is that they acquire sufficient skill to give certain standard tests, like those of Binet and Simon, according to directions. It is visionary to suppose that a differential diagnosis of cases can be made by a few routine tests. The results of such testing do have one value, however: they contribute valuable *preliminary data for a later individual differential diagnosis by an experienced mental examiner.* Clinical psychology will more speedily become a genuine science of the behavior of individual deviating and

abnormal persons, and will develop a practically useful art of orthogenics, if we recognize at the outset that the problems of this science are extremely complex, complicated and baffling, and that they can be adequately handled only by trained experts.

GRAPH II.

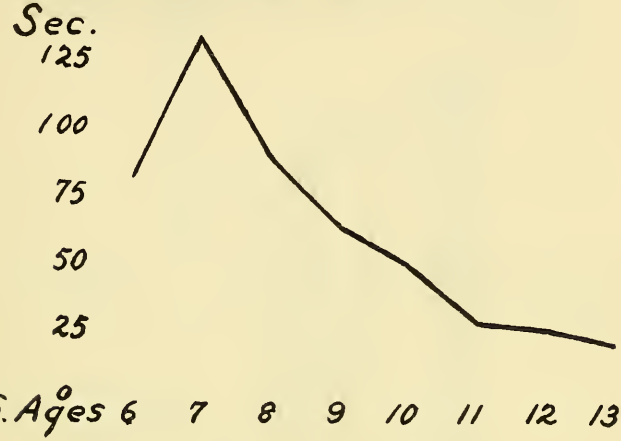
Time to name 4 Colors.

GRAPH III.

Number of Words in Three Minutes.

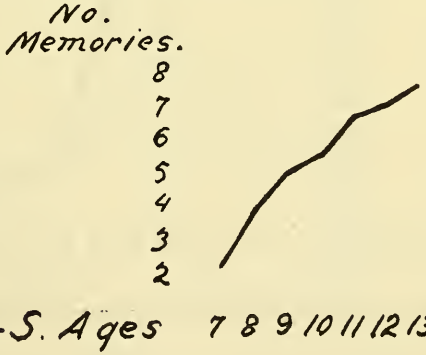
GRAPH IV.

Time to Read Selection.



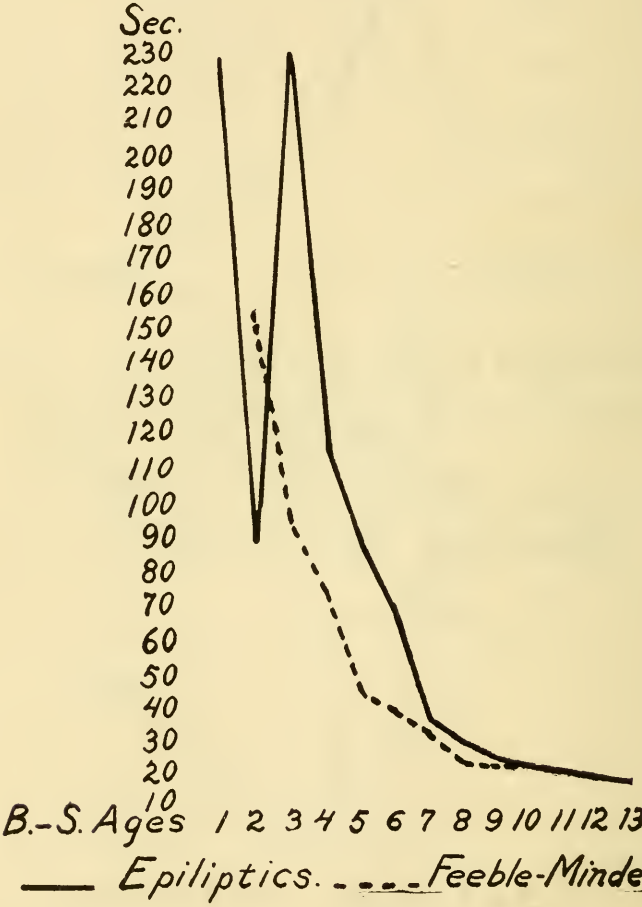
GRAPH V.

Units Reproduced from Reading Selection.



GRAPH VI

Time to do Form Board Test.



Graph VII

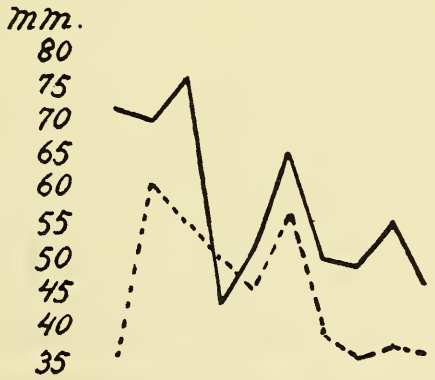
Hand Dynamometrg.

B.-S. Ages 3 4 5 6 7 8 9 10 11 12 13

—— Right. - - - Left.

Graph VIII

Ataxiagrams (Eyes Fixated)



B.-S. Ages 4 5 6 7 8 9 10 11 12 13

—— Antero-Post - - - Lateral.

CHAPTER IV.

A PRACTICAL GUIDE FOR THE ADMINISTRATION OF THE BINET-SIMON SCALE FOR MEASURING INTELLIGENCE.[1]

Various considerations have constrained me to prepare this guide. First, results derived from the application of the B.-S. scale to various classes of defectives will have no comparative value unless uniformity is observed in the administration of the tests. Discrepancies in the results of different experimenters are often entirely traceable to differences in the method of giving the tests. Naturally, some methods will be bad, some good and some indifferent; in any case, the results will generally hinge on the particular method used, and they will have little comparative value unless a *standardized* procedure has been followed. In the simpler tests the standardization will often not need to be elaborate, but a minimal amount is always essential.

Secondly, it is my experience that uniformity in experimental procedure is out of the question in any branch of psychological research unless the *conditions, method and procedure are definitely and fully formulated.* There is a peculiarly urgent need for explicit directions in the administration of the B.-S. scale, because the tests are being given by persons with little, if any, scientific (and particularly any

[1]Reprinted, by permission, with minor alterations, from *The Psychological Clinic*, 5: 1911, 217-238.

psychological) training, and who therefore are in no position to formulate a correct procedure for themselves, nor to foresee or circumvent the methodological pitfalls which lurk in all kinds of scientific work. Hence, to be of practical value the directions for handling the B.-S. scale should be given in the form of a compact, condensed guide, instead of being scattered throughout a bulky text, and the procedure, the questions or directions, should be so formulated that they can be used verbatim.

Thirdly, some of the tests have not as yet been sufficiently detailed, conditioned or standardized, obviously because this cannot be satisfactorily done *a priori,* but only after extensive testing. The scale has now been used and criticised somewhat freely, so that we are in a position to improve the procedure at various points and to offer various suggestions. In doing this it is advisable to proceed along conservative lines and disregard such suggestions as have not been subjected to the test of experience.

Fourthly, as shown in the preceding pages, the 1908 scale itself, aside from the procedure, is imperfect at various points, whence, while these imperfections are not such as to render the 1908 scale worthless, there is imperative need to carry forward the work of revision and improvement, so that we may eventually obtain a maximally reliable scale. But this work (with normal children, of course) cannot be satisfactorily done unless a fairly uniform and standardized procedure is followed; without this we can expect nothing but conflict and discrepancy. It does not seem advisable to revise the 1908 scale for American use until it has been more extensively tried out in accordance with a standardized procedure.

The 1911 revisions do not commend themselves to the writer. Elsewhere[1] the suggestion has been made that workers who use the B.-S. tests for *research* purposes should publish their results in terms of the *complete, standardized* 1908 scale.

It is in the hope of aiding the work of standardizing the experimental procedure that the following guide has been prepared—not as a finality, but as a practical pathfinder. The attempt has been made to outline the procedure which I have found most satisfactory, but advantage has also been taken of the suggestions of other writers. To explain why one form of procedure should be used and another avoided, or to enter upon an explanation or justification of the tests themselves, would require more space than is here available. It is intended to make this guide supplement, rather than supplant, the statements or texts already extant. It may reasonably be expected that anyone who intends to use the scale should familiarize himself with at least the English versions.[2]

I have followed the 1908 series, except that the

[1] J. E. Wallace Wallin. *Danger Signals in Clinical and Applied Psychology. Journal of Educational Psychology*, 2: 1911, 224.

[2] Cf. Binet et Simon. *Le Développment de l'intelligence chez les enfants.* Année Psychologique, Tome XIV. Otto Bobertag. *Ueber Intelligenzprüfungen (nach der Methode von Binet und Simon).* Zeitschrift für angewandte Psychologie, 5: 1911, pp. 105-203. Henry H. Goddard. *Binet's Measuring Scale for Intelligence.* The Training School, 6: No. 11, 1910. E. B. Huey. *The Binet Scale for Measuring Intelligence and Retardation.* The Journal of Educational Psychology, 1: 1910, 435f. Katherine L. Johnson. *An English Version of M. Binet's Tests for the Measurement of Intelligence.* Training School Record, London, November, 1910. F. Kuhlmann. *Binet and Simon's System for Measuring the Intelligence of Children.* Journal of Psycho-Asthenics, 15: 1911, Nos. 3, 4. Guy M. Whipple. *Manual of Mental and Physical Tests.* Baltimore: Warwick & York, Inc., 1910, Chapter 13.

tests for idiocy, 1 to 6, have been added from the 1905 series. Tests 17a and 50a have also been added. The order in which the tests appear corresponds closely with the originals.

THE BINET-SIMON DIAGNOSTIC TESTS OF MENTAL AGE (INTELLECTUAL DEVELOPMENT).

(Abbreviations: S = subject. E = experimenter. + = passed. — = failed.)

Name Address Born Place of birth Nationality Sex Health Physical defects Speech defects School grade School standing (years pedagogically retarded or accelerated) Examined By Mental condition during test GENERAL RESULTS: passed tests of mental age Chronological (actual) age Years retarded intellectually DEGREE OF MENTALITY: SUPERNORMAL, NORMAL, SUBNORMAL, BACKWARD, FEEBLEMINDED (LOW, MIDDLE OR HIGH IDIOT; L., M., OR H. IMBECILE; L., M., OR H. MORON).

Tests for Idiocy—Mentality of 1 to 2 Years.

Age 1.

1. Move lighted match slowly before S's eyes (or ring bell from behind S). Mark + if eyes follow or S listens. Watch for incoördinated eye movements.

2. Place small block (cube) in palm of S's hand, with statement, "Here is something for you." + if S grasps and handles. Prehension from tactual stimulation.

3. Move colored ball or cylinder, suspended by string, slowly before S's face (eyes) or hands, without touching. + if S grasps and handles.

Age 2.

4. Hold before S, or place within S's reach, a piece each of candy (or cookie) and wood of equal size. Avoid favored position for either. + if candy is chosen.

5. Wrap paper about candy in S's sight and hand packet to S. + if S removes paper before eating.

6. IMITATIONS: E extends hand for greeting as S enters room. "Do as I do;" or: "Do this way." E claps hands; hands in front, on head or shoulders; rises on toes, etc.

COMMANDS (by gestures or words): "Sit down," "Stand up," "Shake hands," "Pick up" (object purposely dropped by E), "Give me that book." + if S imitates simple movements or executes simple commands. Watch for failure through negativism or stubbornness.

Tests for Imbecility—Mentality of 3 to 7 Years.

Age 3.

7. "Where are your eyes?" "Nose?" "Mouth?" "Hair?" Or: "Open your mouth." "Close your eyes," "Touch your nose." + if S correctly points to parts.

8. "Repeat" [alternative forms: "Say after me," or: "See if you can say just what I say without making a single mistake." Or: "I'm going to read a sentence (or tell a little story). When I get

through I want you to say it word for word, just as I did, without a single mistake. Now listen carefully"]:—

" 'It is cold and snowing.' (Say that.) Or: 'My dog's name is Fido.' Or: 'In summer it is warm.' " E speaks slowly (not too slowly, or haltingly), distinctly, with expression, while there is *no noise* and S is *attentive.* Shield sentences from S's eyes. No repetitions allowed. E records reproduction verbatim.

Six syllables in *one* sentence. Use other six syllables in single, complete, easy, concrete sentences if above become familiar. + if S reproduces one of the three absolutely correct. (Cf. Tests 17a, 21, 58.)

9. "Repeat" ["I'm going to say some numbers. Listen carefully, because as soon as I get through I want you to say them just as I did. Now listen"]: '7 2,' ('Say that.' Or: 'What did I say?'); or: '9 1;' or: '3 8.' " See directions under 8. If necessary, illustrate thus: "so when I say '8 5,' you must also say '8 5.' " Pronounce digits distinctly *once,* as single, detached units, without accent, one-half second apart. Avoid consecutive numbers. Shield numbers from S's eyes. **Two** digits. One out of three absolutely correct passes. (Cf. Tests 14, 31, 50a, 56.)

10. "What do you see in this picture?" "What is it about?" Or: "Look at this picture carefully and tell me what you see, what it is about." If necessary, urge; "anything else?" Show S only familiar pictures in colors of people and situations, *strongly suggestive of action.* Of the Jingleman Jack pictures (these and all the other supplies for

the Binet-Simon tests can be secured from C. H. Stoelting Company, 121 N. Green street, Chicago, Ill.) the best are probably the pictures of a man chasing children from the steps, of the plumber and the defective water pipe, of carpenters building a house, of a man mowing grass, and of a man cutting hair. All these are admirable for purposes of *simple enumeration* and *description,* but not so good for eliciting an *interpretative* response. Pictures equally good for all three purposes are needed. Simple **enumeration** of objects passes (series of substantives. (Cf. Test 32.)

11. "What is your name?" Preferably asked at beginning of sitting. *Family* name required.

Age 4.

12. "Are you a boy or a girl?" (asked of boys). "Are you a girl or a boy?" (of girls).

13. Show successively a *key, penny, knife* (or *pencil*). "You know what that is. Well, what is it?" Correct naming or interpretative actions pass.

14. "Repeat: '7 4 8.' Or: '5 9 7.' Or: '1 6 3.'" Follow directions in Tests 8 and 9. **Three** digits.

15. "Which of these two lines (pointing to them) is the longer?"

Point to both at once. Cover rest of paper when necessary. Hesitation = —.

Age 5.

16. "Here are a couple of boxes, which look alike, don't they?" "But they don't weigh the same. One is heavier than the other. Now I want you to lift the one after the other, this way, and give me the one which feels the heavier. Feel carefully." E takes each box successively between two fingers, or the thumb and finger, of the right hand, and lifts it about 1 cm. Use *similar* metal salve boxes of the same size. Filling must not rattle. + if right in 2 of 3 trials, with 3 and 12 grams (or repeat with 6 and 15 grams).

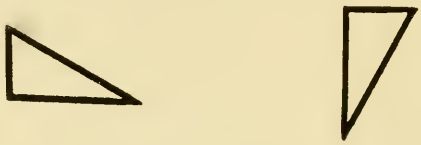
17. "Draw a figure like this (as nearly like this as you can)": + if right angles are fairly well preserved, if figure has squared appearance, or is recognized as an approximate square. Proportions need not be exactly correct. S must use *pen.* Record time. E, non-committal, asks after S has finished: "Is it good?" "Is it like this?"

17a. "Repeat: 'In the winter time we skate on the ice.'

Or: 'I heard a bird singing in the treetops.' Or: 'We should starve if we had nothing to eat.' " **Ten** syllables. Follow directions in Test 8.

18. Place on table before S a rectangular visiting

card, about 4.5 by 7.5 cm., and also triangles cut diagonally from a similar card and placed thus:



"Put these two pieces (pointing to the triangles) together so that the two will look like this one (pointing to the rectangle)." If necessary: "Change them about until you get them right. Now quickly." Repeat instructions if necessary. Restore triangles to original position if they get turned over. At close: "Are you done?" or: "Is it right?" E should not indicate approval or disapproval by manner or word. Record time.

19. Place four bright pennies, heads up, ½ cm. apart, in a row. "You know what these are, don't you." If not, E informs S. "How many pennies are there? Point to each one as you count them aloud." Cf. Test 33.

Age 6.

20. "Hold up your right hand." "Touch your left ear." (Alternative: "Touch your right ear." "Hold up your left hand.") A mistake rapidly corrected = +. The slightest doubt, if not removed by a further question (left eye, right leg), = —. E gives no hint by word or manner.

21. "Repeat: 'In the summer time we like to take long morning walks in the park.'

Or: 'When we get up in the morning we dress and then have our breakfast.'

Or: 'I saw two horses pulling a wagon on a very steep road.' " See directions in Test 8. **Sixteen** syllables.

22. Show the pretty and ugly faces in pairs. "Which of these two faces is the prettier (or uglier)?" Or: "Which is the good-looking one?" 1 2 3 All three must be correct. Both are pretty = —.

23. "You know what a fork is, don't you?" ("You have seen a fork." "Well, tell me, what is a *fork?*" If necessary, repeat and urge. Similarly for *chair, table, horse, house, mama.* (Alternative words: *spoon, bed, drum, cow, father.*) Record replies verbatim. **Definition by stating use,** or **material or parts** of object passes (3 out of 5). E. g., a fork is to eat with. A fork is made of wood and iron. A fork has a handle and tines. **Classificatory or logical definition** (class or superordinate term) passes Test 44. In case a classificatory definition has not been proffered spontaneously, say, after S has finished the series: "Good, so we may say that a mama is a ———?" And similarly with the other words, proceeding in reverse order (*i. e.*, house, horse, table, chair).

24. "Now I want you to do something for me (do me a little favor). Take this key and place it on that chair (pointing); then shut (or open) that door (pointing); and then bring me that box. Remember, first the key on the chair, then shut the door, then bring the box. Now go." Make certain that the child perceives the objects. No aid. Triple order must be entirely correctly executed.

25. "How old are you?" Answer in years


1
2
3

passes. Verify by official record. (Supplementary: "When is your birthday?")

26. "Is this morning or afternoon"—or: "Is it the morning or afternoon now?" Reverse order in the afternoon. Emphasize both terms equally.

Age 7.

27. Show the unfinished figures (p. 128) one at the time. "What is lacking (or missing) in this picture (for the standing woman)?" Or: "in this face (for each of the faces)?" "Look at it carefully." Three correct out of 4 pass. Expose pictures one at a time. "Eyes" instead of "eye," and "hands" instead of "arms" = +. "One ear" for face without eye, and "one eye" for face without nose = —.

28. "How many fingers have you on your right hand?" "On your left?" "On both hands?" Prompt answers, without counting, required for all three questions. Correct number of fingers, with or without thumbs, passes.

29. Ask S to write the following from copy:

("Copy these words." Record time. + if legible to one unfamiliar with original.

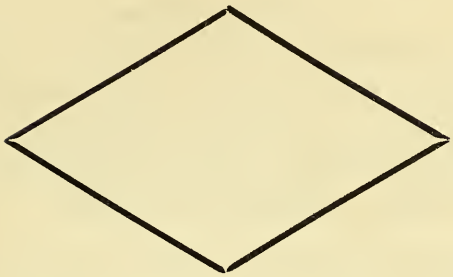
30. "Here is a figure that I want you to draw. Make it as much like this (pointing to the diamond) as you can." Or: "Draw one like it." Record time. Must be recognizable as a diamond. (See Test 17.) (Supplementary question: "What do you call the drawing?"

4

3

1

2



31. "Repeat: '4 7 3 9 5.' Or: '1 4 6 2 8.' Or: '4 5 9 3 7.'" See directions in Tests 8 and 9. **Five** digits.

32. Same as Test 10. **Description** *of actions and scenes* passes. S must tell what is *taking place,* what is *being done,* in the picture. Sentences or phrases, instead of disconnected words. Correct **explanation** or **interpretation** of the pictures (S tells *why* they are doing so and so—subjective interpretation of actor's characters or motives), also passes this age—and possibly entitles him to a credit in Age XII.

33. Counts aloud 13 pennies as in Test 19. S must touch each with finger. No omissions or double countings.

34. "What is that?" Display (but not in the order of value) successively the heads of a *bright* penny, quarter, dime and nickel. No error. Cf. Test 48.

Test for Moronity—Mentality of 8 to 12 Years.

Age 8.

35. "I want you to read this piece (or story) aloud." Place the following before S (53 words):

Three Houses Burned.

New York, September 5th.—A fire last night burned three houses in Water Street. It took some time to put it out. The loss was fifty thousand dollars, and seventeen families lost their homes. In saving a girl who was asleep in a bed, a fireman was burned on the hands.

Two seconds after S has finished, continue: "Now tell me what you read about." "What did it say?" "Tell me as well as you can in your own words." Later: "Anything else?" No specific questions, no aid (except to pronounce difficult words), but give time enough. Purpose of test unknown to S. Record time of reading, miscalled words and verbatim reproduction. Observe speech defects. Score as follows:

New York, | September 5th. | A fire | last night | burned | three houses | in Water Street. | It took some time | to put it out. | The loss | was fifty thousand dollars, | and seventeen families | lost their homes. | In saving | a girl | who was asleep | in a bed, | a fireman | was burned | on the hands. | (20 memories.) One-half credit may be scored for the following part-unities: September | 5th | three | houses | Water | Street | seventeen | families | fifty thousand | dollars. Unessential words may be omitted without loss. **Two memories** or unities (simple ideas, as above) pass.

36. Show S 3 one-cent and 3 two-cent stamps, pasted in a row on a card thus: 1 1 1 2 2 2. "You know what these are?" If S does not know, tell him the value of the stamps. "How much would you have to pay for all of them at the postoffice?"

Or: "What do they all cost?" "Point to each one and count them up." **Time limit: 10 sec.**

37. Place saturated (but not glossy) red, yellow, green, and blue papers (2 by 6 cm.), pasted on a gray cardboard, before S. Point to each color in succession, beginning with red, as rapidly as possible, saying: "What do you call this color?" (Or: "I want you to name these colors, as I point to them, as fast as you can.") Don't ask, "What kind of a color is that?" or: "Which color is that?" Must name all correctly. **Time limit: 6 sec.**

38. "I want you to count backward from 20 to 0 (or 1) as fast as you can." If necessary, add: "Begin with 20, then 19, and so on. Now quickly." No prompting. One omission or transposition allowed. **Time limit: 20 sec.**

39. Give S a pen. "I want you to write a little sentence (or story) which I shall give you. Now listen carefully: 'The pretty little girl.' (Or: 'Cats like to play with rats.') Now write that." E may repeat sentence, but should not show copy. Record writing time. Orthography need not be perfect. Tell S, if necessary, to spell the best he can. Must be legible to one unfamiliar with original.

40. "You know what *paper* is?" "And *cloth?*" "Are they the same (or alike)?" "No; why not?" "What is the difference?" Same procedure for *butterfly* and *fly, wood* and *glass.* For the latter two the questions may be abbreviated if S has grasped the idea: "What is the difference between —— and ——?" (Alternative pairs: *knife* and *fork, sugar* and *salt, stone* and *egg.*) The distinctions should be made from memory. **Time: 2 minutes for 2 of the 3.**

Age 9.

41. "What *date* is it today?" If necessary: "What *day* of the week (or: which one of the week days?" "What *month?*" "What day of the *month* (*number* of the day)?" "What *year?*" Date (day of month) may be three days wrong.

42. "Now tell me the names of all the days of the week in the right order as fast as you can." "What do we call the week days? Now quickly." May start on any day. No prompting. **Time limit: 10 sec.** (Supplementary questions: "How many days in a week?" "If today is Monday (or Thursday, or Saturday), what day was yesterday?")

43. "Suppose that we play store a while. You are the storekeeper and I come to your store to buy 4 cents' worth of candy (or gum, peanuts, etc.), and give you this quarter (or 25-cent piece). How much change (money) would you have to give me back? There is the money; now pick out the change and hand it to me." If S says 21 cents, reply: "Good; now count out the money." Place on the table, face up, without overlapping, 13 pennies, 5 nickels and 3 dimes. S must actually count out the change. The test is in need of standardization. E may try 25 cents — 6, or 25 cents — 5, or 25 cents — 7 (25 cents — 9 is too hard); or $1.00 — 80 cents.

44. Same as Test 23. **Classificatory definition** passes (giving class term or superordinate concept); *e. g.*, "A table is a piece of furniture; a chair is a movable seat; a fork is a table or eating utensil; a horse is an animal, or a four-footed animal that pulls; a mama is a mother, or a woman with a child."

45. Same as 35. **Six memories** pass.

46. Place the boxes fairly near together, but out of correct order, in a row before S. "Here we have five boxes. They look alike, but don't weigh alike. I want you to lift them this way (see Test 16), and give me the one that feels the heaviest. Feel carefully." After S has selected the heaviest: "Now give me the heaviest one of the four." Then: "Now the heaviest of the three," etc. E places boxes on table in the order selected by S, and makes a record of each trial (paste initials of weights on under side). S may be allowed to revise. ("Are you satisfied?" "If you like, lift them rapidly again"—in the order in which selected). Use 3, 6, 9, 12 and 15 grams. Boxes must be indistinguishable. **Time: 3 minutes for two correct** in three trials if necessary. (Supplementary: number of mistakes = the number of changes needed to give the right order, from 2 to 12.)

Age 10.

47. "Tell me the names of all the *months* of the year in the right order as fast as you can." "What do we call the months?" May start with any month. No prompting. One omission or inversion allowed. Verbatim record. **Time limit: 15 sec.**

48. "What is that?" Or: "What do you call this coin (or bill)?" As in Test 34. Use cent, nickel, dime, quarter, half-dollar, dollar, and one, two, five and ten dollar bills.

49. "I want you to make up a sentence in which you must use the words *boy, river* and *ball* (or *New York, money, river,* or *girl, dollar, lake*). You can make the sentence long or short, and you can use any other words that you like, but you must use the three

words *boy, river* and *ball.*" Or: "Tell me something about a boy, a river and a ball, all in one sentence." If S stops with two of the words: "But you must also say something about *ball* (or whichever word is omitted) in the same sentence. Now try again." The statements may be imaginative, but should not be absurd. A **compound sentence with two distinct ideas** (two co-ordinate phrases) passes: *e. g.,* "The boy crossed the river, and went to a ball." "New York has several rivers, and very much money." Three sentences or three independent clauses count failure; *e. g.,* "The boy is strong; the river is wide; and the ball is round." Cf. 52. **Time limit: 1 minute.**

50. Ask S, moderately slowly and distinctly, the following questions (one repetition allowed if necessary): "What's the thing to do?" (or: "What ought you to do?"):

(1) "When you miss a train?"

(2) "When a friend hits you without meaning to?"

(3) "When you break something that belongs to somebody else?"

(4) "When you are on the way to school and find that it is later than usual (or notice that you'll be late for school)?"

(5) "Before you take part in something important (or in some important business)?"

(6) "What should you answer when asked to say what you think (or give your opinion) about someone you don't know very well?"

(7) "Why should we forgive a wrong done by someone when he is angry (or when he is mad) more quickly than when he is not angry?"

(8) "Why should you make up your mind about (judge) a person by his *actions* rather than by his *words* (or by what he *does* rather than what he *says*)?" Record answers. Five correct pass. **Time limit: 20 sec. each.** Use judgment in marking. Illustrative replies: (1) + : Wait for the next. Take another. — : Hurry. Go to the next station. Walk. (2) + : Forgive. Excuse. Don't be angry. Don't cry. Don't do anything to him. Don't tell mother. Say nothing. Tell him to be more careful next time. — : Hit him. Cry. Tell mother or "grown-ups." Get angry. Avoid him. (3) + : Apologize. Offer to pay, or buy another. Fix it. — : Run away. Let it lie. Let him break something of yours. Weep. It is a shame. (4) + : Hurry, run. If S says: "Ask pardon of, or tell, teacher," give chance to correct by emphasizing: "When you are still on the way?" — : Go home. Go the next session. Cry. Think over what to say. Get up earlier. Ask what time it is. (5) + : Prepare. Think it over. Get ready. Practice. Ask someone. — : See if you have time. Ask if you dare. Say you'll do it. (6) + : I don't know. I don't know him. Say nothing. Say what I know. — : I don't know what his name is. Ask what his name is. He is good, or he is bad. (7) + : Because when angry we act without thinking, can't control ourselves, not responsible. — : Because we ought to forgive. The Bible says so. (8) + : Actions speak louder than words. Can see what he does. May not mean what he says. — : Because he is wrong.

Supplementary problems: the following may, after trial, be fitted into their proper ages. Some of the above are too easy, others too hard for Age X;

"What ought you to do?" (1) "When you feel sleepy?" "Cold?" "Sick?" (2) "When somebody has stolen something (or your pencil, knife, ribbon, etc.) from you?" (3) "When somebody has told a lie about you?" (4) "When the house you are living in catches fire?" (5) "When somebody says he is sorry (begs pardon) because he has hurt (offended you)?" (6) "When you have been punished, although you have done nothing wrong?" (7) "When you want to buy something (cap, ball, dress, doll, etc.), but don't have the money?" (8) "Why is it easier to *say* that you'll do something than to *do* it?" The first three questions in the first and the first four questions in the second set are easier than the remainder.

50a. "Repeat: '7 1 9 6 5 3.' Or: '4 8 7 2 5 1.' Or: '3 7 6 9 8 2.'" See Test 9. **Six digits.**

Age 11.

51. "I am going to read you some sentences in which there is something silly (foolish, or absurd, or a catch). Listen carefully, and try to tell me what the nonsense is." If necessary: "Can you say that?" "Why not?" If the answer is unclear: "How should it read?"

(1) "Yesterday there was an accident on the railroad, but it wasn't serious; there were only forty-eight killed." (2) "The police found yesterday the body of a young girl cut into eighteen pieces; they think that she killed herself." ("Do you think so?") (3) "I have three brothers, Paul, Ernest and myself." ("Who were they, then?") (4) "A poor carpenter fell, broke his head and died. They have

taken him to the hospital, but do not think that he will recover." ("What did they do that was foolish)?" (5) "Someone said: 'If I should kill myself, I wouldn't do it on Friday, because Friday would bring me bad luck.'" Speak clearly, slowly and with expression. **Time: about two minutes** for three correct.

Illustrative marking: (1) + : Forty-eight are many. That was serious. — : It can't be serious. It might have been worse. (2) + : Could not cut herself into eighteen pieces. — : Somebody may have murdered her. She wouldn't kill herself. (3) + : You have only two brothers. You cannot be your own brother. "Myself" is no brother. Should not say "myself." — : Say "I" instead of "myself." Place "I" before the two brothers. (4) + : He is already dead. A dead man can't recover. Should not have taken a dead man to the hospital. — : They can cure him if he has not hurt himself badly. He cannot live. (5) + : If you kill yourself, the day doesn't matter. Friday cannot bring bad luck to a dead man. — : That is superstition. Friday is no more unlucky than any other day. He wouldn't commit suicide.

Supplementary list. After due trial some of the following should prove available at some level: (1) "Last night I saw a man in the street, with his hands in his pockets and twirling a cane." (2) "Next Christmas was a beautiful day, and we received many presents." (3) "Last Friday two of my friends called upon me. In the evening all four of us went to the theatre." (4) "It would take us all day to walk from New York to Chicago." (5) "Johnny bought a little rubber ball. He paid $1.00 for it."

52. Same as Test 49. **Simple sentence (single idea), or complex co-ordinated sentence,** passes, thus: "The boy threw the ball into the river;" "As I was walking in New York, I found money near the river."

53. "I'm going to give you a few minutes in which I want you to speak as many single words as you possibly can; not sentences, but *single* words; any words at all, just as they come, like *school,* or *dog,* or *cap,* or *grass.* Speak aloud. Now, remember: just as fast as you can." If S stops: "Don't stop." "More yet." Verbatim record. **Sixty words,** exclusive of duplicates, in **three minutes.**

54. "You know what *kindness* means?" "What does it mean?" "Tell what it is to show kindness." If necessary: "Give an example." Allow time as long as S reflects. Same for *charity* and *justice* (*jealousy*). Two correct, with essential idea (phraseology immaterial): *kindness* requires notion of goodness, affection, sympathy, helpfulness; *charity,* of aid rendered unfortunate people; *justice,* of law or rule or treatment according to deserts, fairness. Justice is to be just = —.

55. "Here is a sentence (show the first one) in which the words are all mixed up (or are out of place). I want you to read it through aloud, and then put the words together (orally) in the right order, so that they make sense." Or: "Read these words aloud." After S is through: "Did they make any sense?" "No, why not?" ("out of order"). "Good; now put them together in the right order." If S fails on first sentence, E may arrange it for him, but no further aid. Show sentences singly. Two satisfactory. **Time limit: 1 minute each.**

a defends dog good
his bravely master

to asked paper the I
teacher correct my have

evening for we last
park started the early

Age 12.

56. "Repeat: '2 9 6 4 3 7 5.' Or: '1 6 9 5 8 4 7.' Or: '9 2 8 5 1 4 6.'" Directions in Test 9. **Seven digits.**

57. "Do you know what a rhyme is?" "No?" It's a word that sounds like, or ends like, another word; as *cat* like *pat,* or *fat,* or *rat.*" Now give me three words that sound like *ball* (or *coy, day, mill*)." **Time: 1 minute** for three rhymes with one word. Trials with two words.

58. "Repeat: 'The other day I saw in the street a pretty dog who carried in his mouth a basket of strawberries.'

Or: 'Johnny likes to go on visits to his grandmother, because she always tells him many funny stories.'

Or: 'It should be the wish of every child to grow up to become an honest and useful man or woman.'" See Test 8. **Twenty-six syllables.** One out of three correct.

59. "Here are a couple of questions that I want you to try to answer. Now listen. 'A girl who was walking in the woods in a park saw something hanging from the branch of a tree that made her so much afraid that she ran to the nearest policeman and told him what she had seen.' What do you think she saw? What was it?"

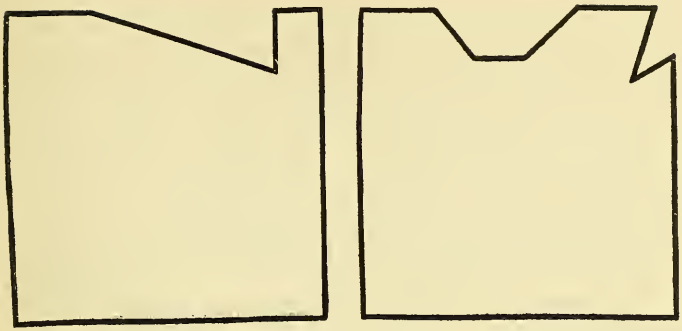
" 'My neighbor has been having strange visitors.

First came a doctor, then a lawyer, and then a preacher.' Why did these three go to his house, the one after the other? What happened there?'' Both answers must be correct: (1) + : A body. A corpse. A man has hanged himself. (2) + : Someone is dying.

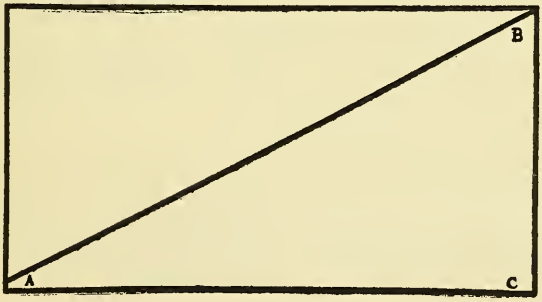
Age 13.

60. Have on hand a supply of paper sheets, about 5 or 6 inches square. ''Watch what I do. Now I fold the paper once this way (into halves). Now once that way (at right angles so that the paper is quarto-folded). Now I cut out a piece here (a triangular hole, about 1x1 inch, in the middle of the closed edge), and now I cut off this corner (the partly closed corner on the same edge). How would the paper look now if I should open it like this (demonstrate with a similarly folded but uncut paper)? Try to imagine that you can see it open like this paper, and draw it the way you think it will look open (or draw the holes as they will look when the paper is open).'' Cut with scissors. Do not show excised triangle, nor indicate how many diamonds there are. I have given + on one diamond.

As children who mingle are likely to coach one another, it is advisable to supplement the test, when used in the same school or district, by using one or the other of the following variant forms, cut similarly in the closed edge of the twice-folded paper:



61. "Suppose I should turn this lower half (pointing to ABC) around, and place it against the upper half (pointing), so that this corner (pointing to C) would touch that corner (B), and so that this edge (CB) would touch this edge (BA); what would the new card (form) look like then? Now I'll remove this lower part (place it a short distance from the other, in the original position), and I want you to try to imagine that you see it placed as I have said, and draw the whole figure. Begin by drawing the upper half the way it is lying." "Good; now the other half the way I said." Speak clearly. One repetition allowed. No further aid. + if angle at B is approximately correct and if AB is longer than CB.



62. "I'm going to give you pairs of words which either mean pretty much the same thing, or which sound somewhat alike, but have a different meaning. I want you to tell me how they differ. What is the difference between them?" *Pleasure* and *honor*. *Evolution* and *revolution*. *Poverty* and *misery*. *Event* and *advent*. *Pride* and *pretension*.

Pass if 3 of 5 are correctly distinguished (if some legitimate difference is pointed out, however crude the language, or if the difference is satisfactorily illustrated).

Suggestions and General Directions for Administering the Tests.

1. Make yourself thoroughly familiar with the tests, their intent and technique, before attempting to administer them. Best of all, attend a demonstration clinic by a psycho-clinicist who has become expert in their use. The fact that the tests do not require delicate instruments of precision does not obviate trained skill in their administration.

2. Attempt to win S's confidence and set him at ease at the very outset. A kindly greeting, a cheerful manner, a sympathetic glance, an assuring smile, a pat on the shoulder will melt the icy barrier with most children. In mental examination the personality of the examiner is fully as important as skill in manipulating the tests. Some individuals are constitutionally or temperamentally unfitted for the work of mental examination.

3. Encourage S, whether he does well or poorly, to do his best by rather fulsome praise or lavish evidences of appreciation. Nothing equals liberal expressions of approbation for inciting a child to put

forth his best efforts. These are *tests, not teaching* exercises. Do not criticise, blame, intimidate or arouse obstinacy. Be tactful and patient, and, above all, adaptable. Dispositions differ. There are some subjects who cannot be won by the arts of praise or cajolery; these must be aroused out of their state of unresponsiveness by other expedients. But it is only seldom that any subjects need to be prodded or threatened.

4. Give no aid other than such as is permitted in the various tests.

5. Adhere unvaryingly to the conditions laid down in each test. Eventually the conditions will be multiplied and improved. The "supplementary" tests, which are extraneous to the Binet-Simon scale, may be given at the discretion of E. "Alternative" questions may be used in testing the same child a second time, or in testing different children in the same school, to minimize the possibilities of coaching.

6. It is not necessary to follow a constant order in giving the different tests. But it is better to start with tests beneath rather than above S's mental level. Initial impressions count for much. Difficult tests at the outset tend to discourage S at the beginning, and thus affect adversely the later tests. The following order is suggested for medium or high grade S's: numbers 35 (45), 10 (32), 46, 42, 41, 47, 34 (48), 43, 49 (52), 50, 51, 54, 23 (44), 55, 31, 14, 50a, or 56, 58, 21, 17a, 53 and 57. It is inadvisable to give 57 immediately before 53, as some fall into the error of supposing that only rhymes are wanted or groups of words in triplets; or 10 immediately before 35, as some S's confuse what was read with what was

seen in the pictures (otherwise 10 makes a good initial test); or 43 before 34 for obvious reasons.

7. Test S extensively both below and above the mental age which he passes, particularly above. Give *all* the higher tests unless it is obvious beyond question that the tests are too difficult. Do not fall into the error of taking things for granted, nor acquire the habit of omitting difficult tests because of indolence. Only by *wide-range* testing shall we be able to arrive at a satisfactory individual diagnosis or be able satisfactorily to criticise or revise the scale.

8. Never examine S's in groups; the work is clinical. Ordinarily, do not examine in the presence of spectators; S should be alone with the examiner or with the examiner and his assistant.

9. The tests should be carried out in a room that is well lighted and free from interruptions or noise. Some tests require absolute quiet.

10. Always record as many details of S's verbal or other reactions as time permits; they may eventually attain a significance not contemplated in the tests themselves. Verbatim records are the ideal to be approximated.

11. In timing, measure the actual time of the *act* of *execution*. This assumes that S begins to respond as soon as the test has been explained, particularly in tests 36, 37, 38, 42 and 47. But if S reacts very slowly, it is advisable to record both the time required to *start* and the time required to *perform*. It is well to avoid a too pedantic insistence on the time conditions. Some S's are slow but thorough. With such a slight overstepping of the time limits is immaterial.

12. E may read the selection in 35 at the normal rate for such S's as are unable to read because of defective vision, but whose intelligence justifies the belief that they could read if they had good eyes.

13. The attempt has been made to standardize the sentences in 8, 17a, 21 and 58 by using only single, simple concrete sentences with a familiar context.

14. The following tests are probably *too easy* for the age standards to which they are assigned: 25, 33, 37, 42, 47, 48, 50 (first set) and 57. The following are probably *too difficult:* 18, 21, 39, 43 (as 25 cents — 9), 44, 45, 46, 53, 54, 55, 58-62. The need to verify these probabilities and to fit all the tests to their proper ages is urgent.

15. The following test, given in connection with 33 or 43, proved suggestive among feeble-minded epileptics: "Which would you rather have, 73 cents or 59 cents (or 62 cents or 48 cents)?" Possibly it is adapted to some age-standard.

16. The following symbols may be used in *marking* the records: plus sign (+), passed; minus sign (—), failed; ½, one-half credit (in rare instances in which the responses are not entirely wrong); ?, evaluation of response uncertain; !, absurd response; I, ignorance or inability to comprehend the question or test; T, timidity; R, resistance; In, Inattention.

17. Credit the examinee (S) with the age in which all the tests, or all but one, are passed. Credit one year for every (additional) five tests passed at higher levels, or .2 year for each advance point (*i. e.,* multiply the advance points by two and express as a decimal. Thus 5⅗ = 5.6). Record the chronological

ages in years and months (thus 8^5), and the mental ages in years and tenths (decimals). The record should be made on a specially prepared record form.

PERSONAL, HEREDITARY AND ENVIRONMENTAL DATA.[1]

It is particularly important to secure the following data in the study of defectives:

Personal Factors (and Anamnesis).

Full name Sex Born Birthplace Nationality Grade Degree and character of education: schools attended months attended Years in each grade Years retarded Nature of reported school capacities Incapacities Character of school work at present Present health Infant and childhood diseases and accidents Vaccination Development (speech, standing, sitting, walking, dentition, pubescence).

Stigmata of degeneration: Anatomical (anomalies of head, face, teeth, ears, limbs, genital organs, skin, body in general).

Physiological (anomalies of sensory, motor, genito-urinary, speech and instinctive functions, and pubertal retardation).

Psychic (feeble-mindedness, aberrations, disequilibration, automatisms, one-sided talents, sexual per-

[1]The author's syllabi for the observational study of the personal, social, industrial-motor and school efficiencies of defectives may be obtained from the New Jersey State Village for Epileptics, at Skillman (Forms III and IV). For a well-balanced syllabus for the clinical examination of children consult EDMUND BURKE HUEY. *Backward and Feeble-Minded Children.* Baltimore: Warwick & York, Inc., 1912, Chapter VI.

version, moral delinquency, eccentricity, delusions, imperative ideas, illusions, hallucinations, psychoses).

Visual acuity Auditory acuity Manuometry Vital capacity Height Weight Nutrition Circulation Pulse Temperature Reflexes Temperament and disposition Attitude toward others Deportment Mental and physical habits, good bad Complexion Color of eyes of hair

Hereditary Factors.

Birthplace of father of mother Number of brothers of sisters Mental and physical conditions of brothers and sisters Order of birth Weight at birth Condition at birth Premature delivery Condition of mother at birth Mother's age at birth Father's age

The following data regarding father, mother and blood relatives: longevity, diseases, deformities, neuroses, psychoses, dependency, vagrancy, drug and alcoholic habits, criminal tendencies, sex perversions, age at death, causes of death

Environmental Factors.

Home conditions sanitary economic moral Father's occupation Mother's occupation Character of community, hygienically, morally, educationally Of street influences Of amusement resorts Of playmates and associates

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